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## THE EDISON MULTIPOLAR DYNAMOS.

In order that the steam dynamo might be practicable in sizes which would admit of the use of large, efficient engines, it was necessary that the electrical part of the machine should be capable of developing a large amount of electricity, to absorb the power developed by a large engine, while its moving parts were limited to a rate of speed which such an engine could furnish without intermediate transmission. This electrical problem was solved by increasing the diameter of the moving parts, thus keeping up their rim speed at a moderate rotative velocity, and multiplying the field magnets so that the rim of the large armature is constantly cutting lines of magnetic force.

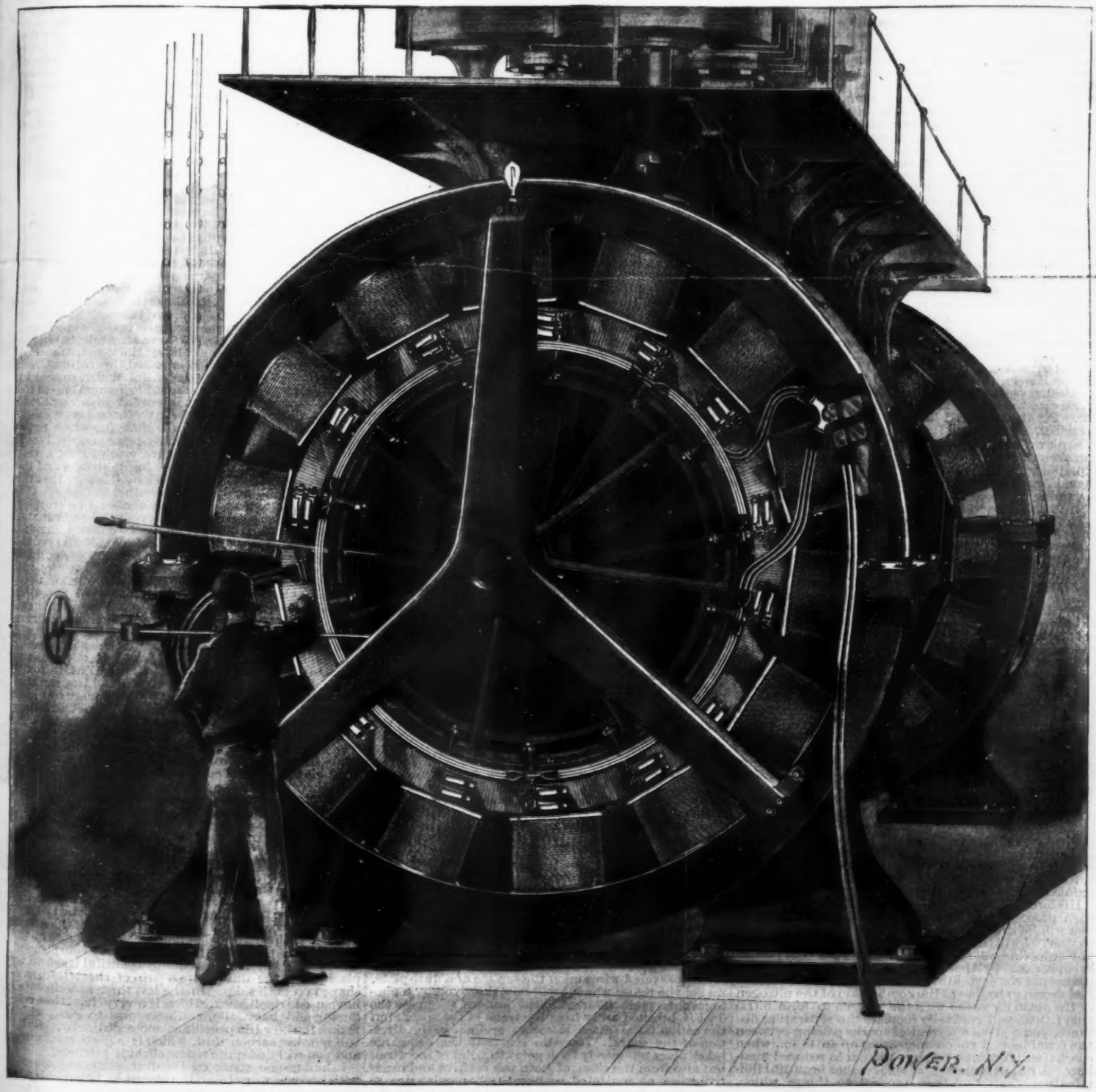
Probably the simplest form of multipolar dynamo is that in which, instead of using only a single magnet, a second magnet is placed opposite the first. This, under the name of the four pole or double magnet dynamo, has been for some time in use, especially among the European builders. A simple modification of this arrangement is the six or more pole type, first used by Elphinstone and Vincent (two experimenters who perhaps have the credit of having constructed the first multipolar drum machine), and familiar in American practice in the Perret motor of the Elektron Co., of Springfield, Mass.

When the several magnets are united we have another type, sometimes called the Thury. This style of field was formerly used in the steam dynamo of the Edison General Electric Co. When the coils are placed upon the projections of the connecting ring, and the ring carried continuously around the outside, we have still another type, known as the Gramme or external yoke, now used in the machines of the Edison Electric Illuminating Co., of New York, at their Elm Street station, and shown in the illustration given below. This is now a common type of multipolar machine in this country, and has been until recently in European practice.

Another type not so commonly used as yet in this country, but recently introduced upon a considerable scale by Siemens & Halske, is made by placing the yoke of the foregoing type in the center of the machine with the magnets radiating from it, and with the armature revolving outside of all.

Still another modification is made by causing the armature to revolve between two sets of magnets projecting horrizontally from the connecting ring.

A natural evolution from this construction, that of making the magnet faces of opposite polarity, introducing the consequent pole type, possesses peculiar features and advantages. The lines of force, instead of traveling in the direction of the movement of the armature, pass from one magnet face to the other, and are cut squarely across. This obviates the necessity, too, of having iron in the core of the armature, as the




MULTIPOLAR DYNAMOS AT THE ELM STREET STATION OF THE EDISON ILLUMINATING COMPANY, NEW YORK.

magnetic flow is induced and completed in the magnets themselves. It is upon this principle that the 20,000 horse power dynamos were attempted at the famous Deptford station at London.

The extension of the diameter of the armature introduces an important feature in the application of drum winding, namely, that whereas in an armature of small diameter the effective wire in which the current is generated bears a large proportion to the total winding, when the diameter is increased the larger part of the wire on the armature is taken up in cross connections, where it is not only of no use in generating current, but increases the resistance of the machine itself. The undesirability of putting this amount of copper into an armature is further increased by the fact that the wrapping of these cross connections one over the other on the end or sides of the armature produces not only a bulky construction, but a part liable to be burnt out, and also a part into which uninflammable insulating material, such as mica, could hardly be introduced. The usual practice, therefore, is to use on large armatures what is known as the Gramme winding. In the Edison dynamo, shown upon the front page, instead of running cross connection wires to commutator segments on the shaft, the brushes are applied directly to the edges of the armature winding, which is left bare. The winding is not a winding as the term would be generally understood, for instead of a continuous wire passing around and around the core, U-shaped copper segments are used, one leg of each segment being joined to the opposite leg of the next segment by cross pieces set into the slotted ends. The brushes are applied to these connecting pieces, as will be seen from examination of the engraving.

While this method of winding has several advantages over the drum winding, it is nevertheless a fact that even with the Gramme winding less than one-half of the armature conductor is effective in the way of generating current, while the other portion, like the cross connection of the drum winding, is dead resistance and detrimental to the dynamo's efficiency.

What seems to be the best modification of the Gramme winding, having in view the overcoming of its defects, consists in what is really a flat Gramme ring, and sometimes called the "rose winding," and this appears to be the very best winding adapted to be used in connection with the consequent pole type previously mentioned. Carl Hering says, "The best method [of modifying the Gramme ring], and one which has proved to be very successful in practice, is to make the ring flat, like a disk with a large hole in it, the pole pieces being then at the two flat sides. Electrically this is equivalent to putting an extra magnet inside of the ordinary Gramme, as it renders both of the long sides of the rectangular armature coils active, and it has, moreover, the advantage that it does not complicate the construction." We are indebted to *Power* for the foregoing and for our illustration.

## INTERESTING ELECTRICAL EXPERIMENTS.

THE hundredth anniversary of the Literary and Philosophical Society of Newcastle-on-Tyne was celebrated recently by a *conversazione* in the rooms of the institution. A large number of local notabilities were present, being received by Dr. Embleton, Dr. R. Spence Watson and Mr. John Pattinson. The National Telephone Company had music laid on, and Dr. Watson read an interesting historical statement of the progress of the society.

Lord Armstrong lectured on "Electrical Phenomena." His lordship said: The Literary and Philosophical Society was founded by a small number of literary and scientific men, of whom my father was one. For thirty years I have had the honor of being president, and as such it is fitting I should contribute in some way to the celebration. I have, therefore, undertaken to exhibit to you this evening some electrical experiments which possess sufficient novelty to render them interesting to experts and, at the same time, entertaining to those who have but scant knowledge of electrical science.

The hydroelectric machine was my first electrical love; but soon after its introduction I became engaged in the hydraulic experiments which led to the establishment of Elswick, and from that time to very recent years the exigencies of business prevented my giving attention to electrical subjects. But I remained faithful to my first love, and resolved to renew my addresses if ever circumstances permitted me to do so. This I did about a year ago, but in the meantime I had grown old and unable to bear the necessary outdoor exposure, so I transferred my affections to a less exacting mistress that would be satisfied with indoor attentions. That second mistress was the Rhumkorff induction coil. My first endeavor was to combine induction coils in such a manner as to form a battery, just as we combine Leyden jars or voltaic cells in battery. There were many impediments to doing this, and, although I have not wholly overcome them, I have succeeded in making a very powerful apparatus upon this principle, which, however, is too cumbersome to be brought here this evening, and is not required for the experiments I intend to show you.

I have a large diagram illustrative of an induction coil. I am doubtful as to the expediency of explaining it, because to do so will be deemed a waste of time by experts, and a bore by those who are wholly ignorant of electricity, but there is an intermediate class to whom a popular explanation may be welcome, and for their sake I will endeavor to make the subject intelligible in as few words as possible.

His lordship here described the induction coil, and then proceeded as follows: Now I dare say many of you will be tired of talk, and more anxious to see than to hear. I will therefore first show you the spark from the induction coil on the table, which is a very powerful one, made by Apps. The short spark with which I commence consists entirely of flame, which Mr. Crookes has shown to be due to the combustion of the nitrogen of the air in its union with the oxygen to form nitric acid; then, as I gradually increase the separating distance, you will see a torrent of sparks passing between the terminals. I go on increasing up to 18 in., when sparks still continue to pass, though in reduced numbers. I will next show you some other beautiful illuminating effects, and then proceed to things which, from their novelty, possess more scientific interest.

Probably many of you are aware that soon after I introduced my hydroelectric machine I designed and made a very large one for the Polytechnic Institution which then existed in London. It proved to be by far the most powerful instrument for the production of frictional electricity that had ever been seen. It was a very short time in my hands after its completion, and I made the best use of my time in trying experiments with it in the open air. Among other experiments I hit upon a very remarkable one. Taking two wine glasses filled to the brim with chemically pure water, I connected the two glasses by a cotton thread coiled up in one glass, and having its shorter end dipped into the other glass. On turning on the current, the coiled thread was rapidly drawn out of the glass containing it, and the whole thread deposited in the other, leaving, for a few seconds, a rope of water suspended between the lips of the two glasses. This effect I attributed at the time to the existence of two water currents flowing in opposite directions, and representing opposite electric currents, of which the one flowed within the other and carried the cotton with it. It required the full power of the machine to produce this effect, but unfortunately when it went to London and was fitted up in the lecture room I could not get the full power on account of the difficulty of effecting as good insulation in a room as in the outside air. I therefore failed in getting this result, after announcing that I could do it, and I dare say I got the credit of romancing. It has ever since been my desire to establish my veracity in this matter, and with the powerful apparatus now at my command I speedily succeeded in reproducing the experiment in a modified form. In fact, I have done it in different forms; but the one which I shall show you this evening is as striking as any, and can be performed with the single induction coil which I have upon the table. The conditions of the experiment are as follows: I take a glass bulb having a long neck on one side and a short nozzle on the other, the nozzle having an aperture of one-tenth of an inch diameter. Through this aperture a string composed of spongy cotton thread is passed. The string is barely sufficiently thick to fill the aperture, and is secured at the upper end by a knot or by attachment to a conducting wire which enters the bulb through a cork at the top of the neck. The bulb is then plunged into a glass cistern, and both bulb and cistern are filled with carefully distilled water, and the cork is tightly inserted in the neck. The whole is placed in the field of the lantern, so as to be exhibited on the screen. And now, all being ready, we will send a positive current into the bulb, and make the cistern negative, and if I am not again sold, as I was at the Polytechnic, you will see the cotton climb up into the bulb. You see it is so, and now I reverse the current and it comes rapidly down. Those who are near will see that there is a clear indication of water rushing out of the aperture all round the cotton. The water in passing the aperture becomes a little heated, and is rendered visible by a flicker, just as hot air becomes visible when it mingles with cold. But the bulb remains full, and if water comes out without lessening the quantity in the bulb, an equivalent quantity must be going in by the same aperture, and as the descending column visibly flows outside of the cotton, the ascending current must flow inside the cotton, and must carry the cotton with it. The two currents become distinctly visible when the cotton is removed, and, though we cannot discern their relative position until they are clear of the aperture, the facts of the case seem to demonstrate that the negative current flows inside of the positive and determines the direction in which the cotton travels. This conclusion appears to me a very interesting one, and may tend to elucidate the relationship between positive and negative currents. When the cork is omitted, the level of the water in the bulb is free to rise or fall, but it remains stationary under the compensating action of two currents. This, however, is not the case when the cotton is in operation without the cork, because the cotton impedes the current which moves it and gives the ascendancy to the outside current, and thereby lowers the level of the water in the bulb. The contrary effect is, of course, produced by reversing the electric current, and the water then rises in the bulb above the level of the water in the cistern.

In the course of experiments I was making on the dispersive effect of the electric spark upon dust, I observe that the disturbed dust always settled in circular lines. Although I afterward found that this fact had been observed before, yet to me it was perfectly new, and, as it appeared to be a very interesting fact, I followed up the subject by an elaborate course of experiments which have yielded a rich harvest of results, revealing the hidden motions which attend the electric discharge.

I have already exhibited to the Royal Society photographs of many of the dust figures I have produced. Those photographs were of dust figures done on cardboard, and the photographs were afterward transferred to glass, and were shown at the Royal Society with the electric lantern. I will show you a few of these photographs this evening by way of introducing the subject, after which you shall see a selection of figures, in actual process of formation, on the horizontal stage of a lime light lantern. In all these figures I shall use plates of glass with a layer of fine dust sifted over them, and shall operate upon the dust by a spark discharge acting in various ways. I use three kinds of dust—calcined magnesia mixed with charcoal in the form of lampblack, tripoli powder, and hard carbon reduced to a fine powder. These three varieties act somewhat differently, and each kind has its application in the production of the best effects. The dust is sifted upon the plates in an evenly distributed layer, and the effects are shown by the manner in which the dust is displaced by the electrical disturbances.

You are all aware that when a gap is made in a conducting wire and a spark passes between the several points, all that can be seen is a streak of fire; but if I lay the severed wires upon the surface of a dust-plate, we get the figure which I will now show you by a photographic plate inserted in the lantern. You see the dust is brushed away from the track of the spark, but the action takes place sideways and not in the direction of the spark. You also see that the discharge takes place not merely from point to point of the wires, but also from the sides of both the positive and negative wires, as indicated by beautifully regular streaks in the dust, the stronger ones being positive and the weaker ones negative. You will also see that there are circular lines faintly visible outside of the central figure, but when a Leyden jar is used as a condenser to give density to the spark, these circular lines come out very strongly, but as I shall presently show you their actual formation, I need not show the photograph. But these circular lines are also produced by a vertical discharge through a hole in the glass, and as it is not easy to do this on the stage of the lantern without piercing the lens, you must be content to see the photograph, which shows the circular lines very distinctly. Another figure involving the same difficulty must also be shown by photograph. It exhibits a dust-plate with six small glass pillars erected upon it to obstruct the motion of the dust. You see the lines are now diverted from the circular form and thrown into arches from pillar to pillar, while the spandrels are filled with inverted curves. You will also see that the ends of the arched lines cling to the glass pillars, notwithstanding the outward drift of air, thereby indicating a strong attraction between the dust and the pillars. I will now dismiss the photographs and proceed to show you the formation of the figures upon the horizontal stage of the lantern, and this is a thing which has not yet been exhibited in public. I will begin with an experiment in which the dust is thrown into circular lines by an electric discharge from a Leyden jar, passing between wires parallel with the surface of the dust, and sufficiently raised above the surface to avoid the sweeping action of the air blast, and I expect you will see the movement in great perfection on the screen. You observe that the dust is thrown into circular lines up to the very center, and a close inspection also shows a very active reciprocal motion among the dust particles themselves, which seem to indicate a transmission of electricity by convection. I will now take another dust-plate, and raise the sparking points to such a height as will save the dust from any disturbance by the discharge. You shall see the dust-plate first, and notice that the spark has no effect upon the dust; but I will now place upon this dust-plate a piece of sheet lead cut into the form of a cross, and supported on four needle points at a distance of one-tenth of an inch above the dust. You would naturally expect that this sheet lead, acting as a shield, would give to the underlying dust additional security against disturbance. But now, after passing a few sparks without effecting any disturbance of the exposed part of the dust, I lift the cross, and you see that the shielded part of the dust is thrown into beautiful symmetrical curves depicting the figure of a cross.

We may go a long way toward an explanation of these curious effects by saying that the particles of dust are polarized, and separated into wave lines by atmospheric vibrations; but this explanation fails to meet all the facts of the case, and for the present I must be content to show you the results without attempting to fully explain them.

I will now discard the Leyden jar and bring the wires down until they lie upon the dust plate, and will take very gentle sparks direct from the coil. On doing so, you see the track of the spark and the off-shoots from the wires. You will also observe that the off-shoots from the positive wire bend round the spark track to get at the negative, while the negative off-shoots seem to make no effort to get round by the outside to the positive. I am therefore led to believe that the negative current follows the inner course, and the positive the outer one, and this is in unison with the cotton experiment, which presented every appearance of an internal and an external current, the inner being the negative current and the one which carried forward the cotton. And now you shall see a very beautiful figure, caused by splitting the positive current and bringing it up to the sparking points in two lines, curved in a manner to show how the dust streaks behave toward each other. The field is not large enough to show the whole figure at once, but by moving the dust plate you shall see it all in parts. There is the figure, and you see a very marked distinction between the inside streaks and the outside ones, which is explained by the fact that the insides face and oppose one another. You see also various dark spaces which show absence of disturbing action, and there is a very peculiar dark band running parallel with the wires, which may be due to a jumping motion from the surface of the plate. You would hardly expect to see such a revelation where nothing was to be seen before but a tiny spark. But we will now banish this spark to a distance and operate upon the dust with the electric emanations from the wires alone, or from metallic terminals in contact with them. The positive and negative wire will then be mere branches from the main circuit, and the spark will take place on the main line and not between the branch terminals. In the first place I will draw down the point of the positive branch vertically so as to touch the center of a dust plate. There is a lead ring serrated on the inner edge surrounding the dust plate to which the negative branch may be attached, although it does not make any difference, beyond exalting the effect, whether I attach it or not. When I turn on the current you see that a circular figure is established on the plate showing radiations which represent the transverse view of what you have seen before. It is probable that self-induction is the operative principle in the production of this sparkless figure; but I observe that whenever electricians are at loss for an explanation they mystify their hearers by attributing the effect to self-induction, and I find it convenient to follow the practice in this instance. You will perceive a slight negative effect proceeding from the ring, but I now reverse the current, and you then see a splendid display of streamers pouring inward from the circumference to the center. A still more beautiful effect will be displayed in the next figure, in which the central part of the plate is occupied by a slender cross of sheet lead pointed at the tips. The influence of the points in the formation of this beautiful figure is very conspicuous. Another variety of figure equally beautiful is shown by placing on the dust plate a strip of sheet lead, saw-shaped on both sides. In the last three experiments I have used tripoli dust, which is a very imperfect conductor, and has a slight adhesiveness to glass, which makes it show the pencilings more distinctly. But I will now use carbon dust, which is a good conductor, and you will find quite a new effect is produced.

I shall use no spark on the dust plate, and operate with branch wires from the circuit as before. In the first place I shall bend down the negative branch perpendicularly, and cause it to touch the dust plate in

the center, and I shall apply the positive branch to the lead serrated ring which surrounds the dust plate. You see the dust rolls up in massive circular waves from the circumference to the center, followed by beautiful streamers from the surrounding points, and altogether presenting a most extraordinary figure, and one of great beauty. I will next put the four-pointed star already used in the center, and proceed the same as in the preceding experiment. You see a figure widely different from the last, and not less beautiful. These dust figures may be multiplied in endless variety; but time will only permit of my showing you one more. I substituted for the four-pointed star a lengthened piece of lead, with parallel serrations on the two sides, and I take away the lead ring, together with the positive branch wire attached to it, and I place the negative wire in contact with the piece of lead now placed in center. As I have removed the positive wire, you will observe that the negative terminal acts without any opposite positive terminal, yet you will see that a figure is produced involving forms and motions which words can hardly describe, but, like all the others, distinguished by symmetry and beauty.

And now I have only one more remark to make. There will be some among you who will ask what use are such experiments as these? I answer that the more we pry into the mysteries of electricity, the more we shall be able to apply it to the service of mankind; but, apart from that consideration, knowledge for knowledge sake is a worthy object of pursuit.

## ANIMAL CHARCOAL AS A DECOLORIZER.*

By T. R. CARSWELL.

THAT animal charcoal must be a mixture of substances of variable composition and properties goes without saying. We are therefore obliged to start with the commercial article and refine it or alter it as we think proper, in order to make it serviceable for the special purpose to which it is to be applied. A complex mixture of substances of variable composition, when treated by any given process, must of necessity yield a product of variable composition, and if the processes employed also vary, the chances and extent of variation will be greatly increased. The difficulty of dealing with such a substance by any pharmacopœial authority will now be apparent.

In a recent paper on "Carbo Animalis, B. P.," by Mr. Hodgkin (*Pharm. Jour.* [3], xxxiii., p. 192), it was hinted that it is impossible to "purify" animal charcoal to the standard required by the British Pharmacopœia. This means that the compilers of the Pharmacopœia have ordered the production of a substance which they only knew in their imagination.

In the old Edinburgh Pharmacopœia the process is similar to the present official process, excepting that the charcoal is ordered to be boiled after the two days' digestion. As the result of the process, we find it stated that "when incinerated with its own volume of red oxide of mercury, it is dissipated, leaving only a scanty ash ($\frac{1}{100}$)." It is impossible to conceive that the latter statement could have been made as the result of anything but actual experiment. Whether such a case is a commonly occurring one is altogether another question, as is also its commercial practicability in general. This only leads to the obvious inference that the composition of the product depends on the nature of the mixtures started with for any given process.

In dealing with the various methods for the purification of bone black, and giving the results of an extensive analytical examination of the resulting products, from an ash point of view, Mr. Hodgkin states that not one of them can be held to give a really pure or satisfactory article, and goes on to state that "the authorities have evidently been under the impression that animal charcoal consisted of carbon and calcium phosphate and infinitesimal quantities of other substances, whereas there are present substances, such as phosphate of iron and alumina, which, after carbonization of the bones, become soluble with very great difficulty, and are not easily removed."

But it may be asked what is a pure and really satisfactory animal charcoal? Is charcoal synonymous with carbon? Will charcoal which is a satisfactory article for one particular operation be a satisfactory one for any other? Doubtless the Pharmacopœial authorities were aware that bones contained iron in common with other parts of the animal organism, and that on incineration iron would be found in the residue of fixed salts. The bone black used in Mr. Hodgkin's critical examination contained a larger percentage of iron oxide, alumina, and silica than many carefully prepared samples, and it is evident that it belonged to a class of bone black (partially fused) which is the product of a very high temperature. The Pharmacopœia defines bone black as consisting principally of carbon, and phosphate and carbonate of calcium. Did the bone black used by Mr. Hodgkin fairly answer to to that definition? I think not. Carbon as such would not alter the solubility of iron oxide or phosphate in mineral acids, nor to any considerable extent prevent its removal, and the same would apply to calcium salts. If a charcoal answering to the official definition were used there is, therefore, no reason why digestion with warm hydrochloric acid, as in the B. P. process, should not remove the mineral matter to the extent required. However, there is no doubt that the commercial article, as usually found, does not yield the results stated by the official process, though there is evidence that some charcoals yield different results from those given by Mr. Hodgkin.

Most charcoals contain a small quantity of oily-looking matter in a very intimate state of admixture, which offers great resistance to treatment by mineral acids, even boiling, and doubtless protects the mineral matter from the action of such acids. I have come across a charcoal which yielded to benzine a considerable quantity of such matter in combination with iron. This would probably, in some cases, account for the coloration of such liquids as acetate of amyl.

It has been remarked that the question really is, "To what extent is it worth while to purify animal charcoal?" In my opinion the question really is, "To what does animal charcoal owe its useful properties and how can its maximum usefulness be attained?" It has been further remarked that "what the actual decolorizing agent in animal charcoal was, he did not think any one knew." Why, then, should we expend labor and money in treating charcoal by certain processes, if we do not first know to what it owes its useful properties? If it owes these properties to the mineral matter, why remove it; and if to the carbon, how best can such a product be obtained? If chemically pure carbon be required for medicinal or commercial purposes, ways and means would very soon be found to produce it.

Knowing from previous work the extraordinary power of minute quantities of iron, especially in presence of calcium salts, in uniting with and fixing large quantities of some organic substances, the following experiments were carried out in order, if possible, to answer the question formerly put—To what does animal charcoal owe its useful properties? or at least to elucidate some points toward a solution of the problem. The materials of experiment were in each case digested for one hour with 200 c. c. of a standard solution of caramel, indigo-carmine, or magenta, a portion filtered off and the percentage of color removed estimated. The experiments may be conveniently tabulated as follows. Charcoal means always animal charcoal:

| Exp. | Materials used. | Percentage of color removed. Caramel. | Indigo-carmine. | Magenta. |
|---|---|---|---|---|
| 1..... | 30 grs. charcoal. | 91 | — | — |
| 2..... | 25 grs. " | 83 | — | — |
| 3..... | 20 grs. " | 82 | — | — |
| 4..... | 15 grs. " | 76 | 95 | 95 |
| 5..... | 15 grs. " 1 gr. $FeSO_4$. | 64 | 97 | — |
| 6..... | 30 grs. $Ca_2PO_4$. | 58 | 0 | — |
| 7..... | 30 grs. $Ca_2PO_4$. 1 gr. $FeSO_4$. | 70 | — | — |
| 8..... | 30 grs. $Ca_2PO_4$. special purer. | 22 | — | — |
| 9..... | 30 grs. $Ca_2PO_4$. special purer. 1 gr. $FeSO_4$. | 64 | — | — |
| 10..... | 30 grs. $Ca_2PO_4$. special purer. 0·2 gr. $FeSO_4$. | 40 | — | — |
| 11..... | 30 grs. $CaCO_3$. | 40 | — | — |
| 12..... | 15 grs. charcoal. 1 gr. iron alum. | 82 | — | — |
| 13..... | 15 grs. charcoal. 5 c. c. $\frac{N}{10}$ $H_2SO_4$. | 100 | 99 | 100 |
| 14..... | 15 grs. charcoal. 5 c. c. $\frac{N}{10}$ NaHO. | 0 | 100 | — |
| 15..... | 12 grs. charcoal. 1 gr. $FeSO_4$. 2 grs. $Ca_2PO_4$. | 91 | — | — |
| 16..... | 15 grs. kaolin. | 20 | — | — |
| 17..... | 12 grs. kaolin. 1 gr. $FeSO_4$. 2 grs. $Ca_2PO_4$. | 82 | 0 | 80 |
| 18..... | 1 gr. $FeSO_4$. 2 grs. $CaCO_3$. | 97 | — | — |
| 19..... | 12 grs. charcoal. 1 gr. $FeSO_4$. 2 grs. $CaCO_3$. | 97 | — | — |
| 20..... | 15 grs. charcoal with acetic acid. | 30 | — | — |
| 21..... | 15 grs. charcoal, heated to redness in covered crucible. | — | 80 | — |
| 22..... | 15 grs. charcoal treated with dilute $H_2SO_4$. | — | 82 | — |
| 23..... | 15 grs. charcoal saturated with indigo-carmine. | — | — | 95 |
| 24..... | 15 grs. charcoal saturated with magenta. | — | 65 | — |
| 25..... | 1 gr. $FeSO_4$. 4 grs. $Ca_2PO_4$. | 64 | — | — |

You will observe from experiments 1, 2, 3 and 4, that within certain limits large increases in the quantity of charcoal used do not perform amounts of work at all proportionate to those increases. It will be observed that there is only 15 per cent. of difference in the quantity of color removed even when the quantity of charcoal is doubled.

Calcium phosphate is very generally put forward as operating largely in the industrial uses of charcoal, and it will be noticed from experiment 6 that in the case of caramel the commercial article can lay good claim to considerable decolorizing power, but experiment 8 shows that this depends greatly on its state of purity, the sample of the latter experiment having been specially prepared in a purer condition. In further illustration of this point notice the results of experiments 7 and 9, where the decolorizing power has risen to 70 and 64, as against 58 and 22 in experiments 6 and 8. We therefore conclude that an increase of iron relative to the quantity of calcium phosphate increases the decolorizing power. Are we to conclude, therefore, that the decolorizing power of calcium phosphate depends on the quantity of iron which it contains? In order to decide this point, experiments 9 and 10 were carried out, and it was found that where 0·2 grain of ferrous sulphate was added the percentage of color removed was 40 against 64 where 1 grain was added, from which we deduce an affirmative answer to the above query.

A reference to experiment 11 shows that this property is not peculiar to the phosphate, but that the carbonate is at least as good, and I shall show later that under some conditions it is a better decolorizer.

Experiment 12 was performed in order to determine whether iron in the ferrous or ferric condition aided the decolorizing power the more, and on comparing the result with that of experiment 5, we find that iron in the ferric state is the more favorable for this particular coloring matter.

The results of experiments 13, 14 and 20 indicate that in the case of caramel, in a mineral acid solution, charcoal produces complete decolorization, in an alkaline solution no decolorization takes place, and in the presence of a vegetable acid the decolorization is only partial. It is interesting to note that if the coloring matter be partially removed by charcoal from a caramel solution and the liquid filtered, the remaining color is immediately and almost completely precipitated by the addition of a mineral acid.

If my proposition be correct, then I should be able to raise the decolorizing power of a charcoal to any given standard by effecting certain changes in its composition, either by the addition or abstraction of certain substances, or by both. Experiment 15 was therefore carried out, and you will observe by comparison with experiment 1 that less than half the quantity has performed the same work as the original charcoal.

Turning our attention from charcoal to some inert substance, I have taken kaolin as representing such a substance. From experiment 16, however, you will see that it is not quite inert, but possesses a decolorizing power represented by 20, which is due, no doubt, to some extent, to mere surface adhesion. On performing experiment 17, which is the same as experiment 15, only substituting kaolin for charcoal, you will observe that the decolorizing power has risen from 20 to 82, as against 76 to 91, as was the case when dealing with charcoal. That is, I have prepared an artificial mixture with a decolorizing power greater than the sample of animal charcoal and nearly as good as the sample manipulated as in experiment 15. At the same time I have shown that the decolorizing power of charcoal depends on the presence of certain metallic salts and compounds in certain proportions, and I have also proved indirectly that carbon has nothing to do with the decolorizing power, at least in the case of caramel. These points are further borne out by a reference to experiment 25, where we find that 1 grain ferrous sulphate and 4 grains calcium phosphate have performed an amount of work nearly as great as the animal charcoal itself and with less than one-third surface exposure.

Experiment 19 was carried out to determine whether calcium carbonate added to the charcoal would offer equal advantages with calcium phosphate, and it will be seen by comparison with experiment 15 that the decolorizing power when carbonate is added is higher than in the case of the phosphate.

In order to prove that extent of surface did not affect the foregoing results seriously, the specific gravity of the calcium phosphate, kaolin, and charcoal were taken and found to be 2, 2·4 and 2·5. The degree of comminution did not vary greatly, and therefore the total surface exposure would be fairly equal.

On comparing the experiments with indigo-carmine, we are struck by the fact that they are entirely antagonistic to those with caramel, and contrary to what we should have expected by analogy. It is seen in experiment 17 that the result is nil with indigo-carmine, and indeed the color was rather increased, and in experiment 6 the color was increased to deep blue. From experiments 4 and 5 we find that animal charcoal decolorizes a considerable quantity of indigo-carmine, and that the addition of iron raises the decolorizing power only to a very trifling extent. From experiments 13 and 14 it will be seen that the presence of acid or alkali makes practically no difference in the result in the case of indigo-carmine.

In reviewing the results of the experiments dealing with magenta, of which only a few have been tried, we find that, in the main, the results agree with those found in the case of caramel. Experiments 23 and 24 show that a charcoal apparently saturated with one color may be capable of decolorizing a solution containing another coloring matter to the same extent as the original charcoal.

In the case of indigo carmine, I have shown that the mineral constituents of charcoal have no power to decolorize a solution of this substance. The decolorizing influence seems to be due to the physical condition of the charcoal, and that the indigo carmine is removed by a process of imbibition or sponging. Certain experiments, which need not be detailed, appeared to support this theory. It is not, therefore, the carbon as such that causes the decolorization, for other substances offering the same physical conditions were found to exercise the same decolorizing power.

In determining the carbon of a charcoal it is customary merely to dry and burn the sample and calculate the carbon by loss. The following analysis will show that such a process is fallacious. Sample 1 was purified by Mr. Hodgkin's process, and sample 2 by a modification in which it was first treated by acid, then with caustic soda, and again with acid. An analysis of the two samples made from the same sample of bone black gave the following results:

| Sample | C. | H. | N. | O. | Ash. |
|---|---|---|---|---|---|
| 1. Acid process.... | 67·92 | 2·14 | 10·6 | 7·54 | 12·1 |
| 2. Acid + alkali process..... | 71·01 | 2·01 | 6·9 | 10·48 | 9·6 |

The use of alkali was intended to destroy oily or nitrogenous matter, and thus give free play to the acid, and the result shows a diminution in ash and an increase in carbon. On treating the ash with hydrochloric acid the iron dissolved out with comparative ease, but on treating with lactic acid, as suggested by Mr. Hodgkin, the action was practically nil. I think that generally such an ash is ignited at too high a temperature, with consequent fusion. It should be heated for a prolonged time at a comparatively low temperature. An experiment proved that sample 1 possessed rather higher decolorizing power for indigo carmine than sample 2.

Since this paper was written, through the courtesy of Mr. T. B. Groves, my attention has been called to a paper on "Mordanted Charcoals," by Stenhouse (*Pharm. Journ.* [o. s.], vol. xvi., p. 363). Stenhouse prepared artificial decolorizing charcoals containing 7½ per cent. of alumina and 7½ per cent. of calcium phosphate, by adding these to ordinary vegetable charcoal, and also by roasting together hydrate of lime, coal tar pitch, and coal tar. It is interesting to note that the proportions of added mineral matter of the iron type suggested by Stenhouse agree in the main with those which I have found by experiment to be most suitable.

The results which I submit tend to show that carbon as such possesses no inherent power of decolorizing; that the use of animal charcoal for this purpose depends to some extent, especially for some colors, on its physical condition as an aggregation of cellular spaces, but mainly on its mineral constituents; that a research on these lines might furnish us with a decolorizing material having all the advantages and free from the disadvantages of animal charcoal; and that attempts at purification are based on erroneous ideas.

Mr. Dott said he did not quite agree with all that had been said by Mr. Carswell in his criticism of Mr. Hodgkin's paper. It was quite true that, to some extent, the decolorizing power depended on the mineral

* A paper recently read before the Pharmaceutical Society, Edinburgh.—*Pharm. Jour.*

matter in the charcoal. He thought a solution of caramel was hardly suitable for testing decolorizing power, because the colors they generally desired to remove in practice were not analogous either to caramel or indigo carmine. A fluid extract of cinchona or something like that would be a much better colored liquid to use as a test. As to the charcoal itself being a decolorizer he could testify that an animal charcoal purified by treatment with acid undoubtedly possessed considerable decolorizing power. As to the remark that there was no reason why acid should not remove mineral matter from the charcoal, it must be remembered that the charcoal, either by reason of its porosity or from an attraction for the substance, offered a great barrier to its removal by washing. You might, for instance, have some sand saturated with an alkaloidal salt and some charcoal similarly saturated, and it would take fifty times as much water to wash the alkaloid out of the latter that it would take to wash it out of the former. The great point in testing a sample of charcoal was to try its power of removing various colors, and these of a kind such as were usually met with in practical manufacturing operations. He doubted if, even from a sugar refiner's point of view, caramel was a good substance as a test, for it was very doubtful if the color to be removed in the refining of sugar was of the same nature as caramel.

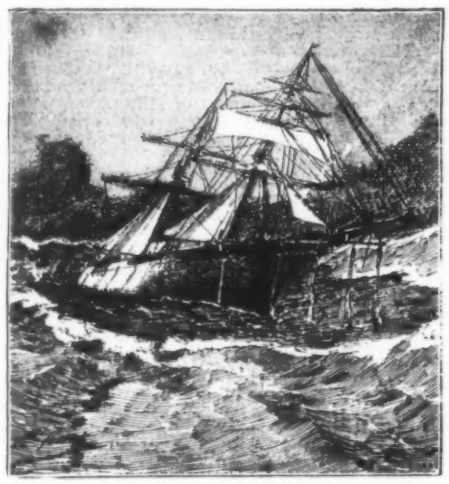
Mr. Gibson said he was inclined to agree with Mr. Carswell, and thought the mineral matter was mainly the cause of decolorization and acted by carrying down the color mechanically. The paper by Stenhouse corroborated this view. Alumina was well known to be a splendid agent for clearing a milky solution.

Mr. Arthur said that sometimes the flocculent precipitate which separated from Easton's sirup was removed by filtration through animal charcoal. It ought to be remembered that Easton's sirup so treated would contain little or no strychnine. He remembered a good many years ago preparing for Sir Douglas Maclagan a fluid extract of pomegranate root bark by Siebold's process, removing tannin by lead acetate and lead by sulphureted hydrogen. During the process he obtained a fine crop of crystals and thought he had got pelletierine, but on examination they turned out to be acetate of calcium.

Mr. Hill said, on hearing of the nature of Mr. Carswell's experiments, he added about one drachm of prepared chalk and three or four grains of ferrous sulphate to a solution of litmus, and on shaking the mixture for a few minutes and filtering, found that complete decolorization had taken place. Neither the chalk nor the ferrous sulphate alone had such an action.

## THE USE OF OIL AT SEA.

IT will be remembered that great anxiety was felt at the news, happily erroneous, of the loss of the Umbria. This magnificent express steamer, represented in our engraving, is in commission between the United States and Great Britain and makes the trips regularly and in good time, but on this occasion required twice the usual time to reach port. It was believed that the vessel was lost, as the meteorological bulletins spoke of a cyclone, the violence of which the vessel must have experienced. A dispatch from America calmed the excitement. The Umbria had been seen in a disabled condition, without doubt from the effects of the cyclone, but with all passengers and cargo safe and sound. The passengers had hardly disembarked when they were asked about the events of the voyage. Some said, "We should have been lost if it had not been for spreading oil upon the water in the height of the tempest." This sentence should afford food for reflection to the mariner. If all navigators of to-day better understood the efficiency of this method, they would not welcome

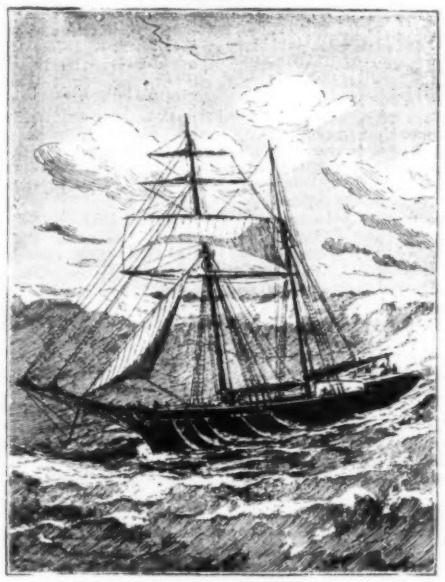


BRIG DRIFTING IN THE TROUGH OF THE SEA WITH OIL SACKS SUSPENDED FROM SPARS.

with an incredulous smile the accounts of the experiments made on this subject, but would hasten to familiarize themselves with the technical details, so as to be able to apply them in case of need. To remedy this professional ignorance the Hydrographic Office of the United States has inserted in the pilot charts directions and rough sketches which appeal to mariners, showing them how to act in cases of necessity.

A translation of the American work has been published in the *Annales Hydrographiques Françaises* for 1892. But this *résumé* does not circulate among all those interested. Therefore it would seem a matter of prime importance to diffuse brief instructions, with numbers of examples, in the chief maritime centers. The office for maps and plans of the marine (of France) has printed them, and urges chambers of commerce of ports to assist in distributing them among mariners, including deep sea fishermen.

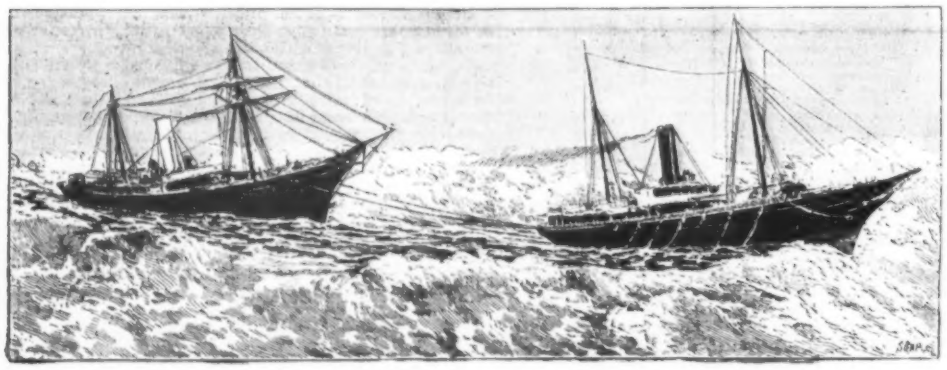
M. Weyl has done much to assist in this diffusion of



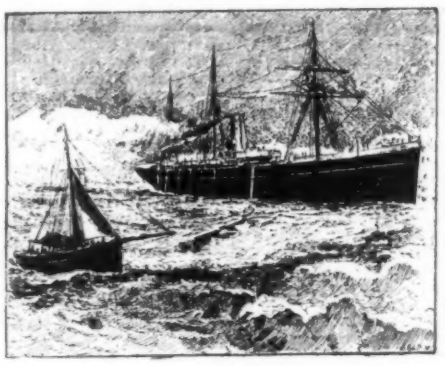
SCHOONER USING OIL BAGS.

knowledge, and he has proposed to compel captains to add to their stores a sufficient quantity of oil to use if their boats become exposed to a dangerous storm. A proceeding of this kind would rapidly make the application of this means of self-protection very well known, especially among coasting and fishing vessels. "Even if you tell the fishermen," said M. Weyl, "to try the effect of oil upon the water, it will be of no use unless they are compelled to carry the necessary apparatus to break the force of the waves."

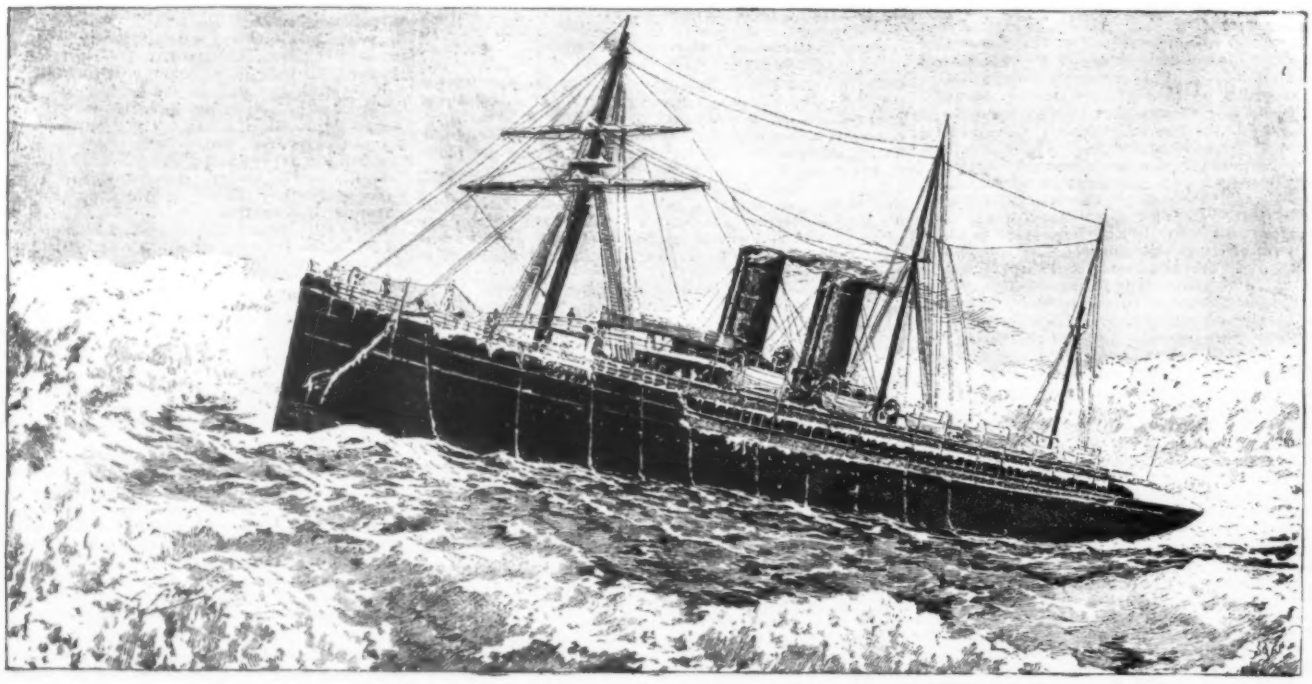
In order to show the method of procedure, we give a number of cuts showing the means by which the Um-



USE OF OIL BY A TOWING VESSEL IN HEAVY WEATHER.



TAKING ON A PILOT IN HEAVY WEATHER--OIL USED TO SMOOTH THE SEA.



THE CUNARD STEAMSHIP UMBRIA USING OIL DURING A CYCLONE.

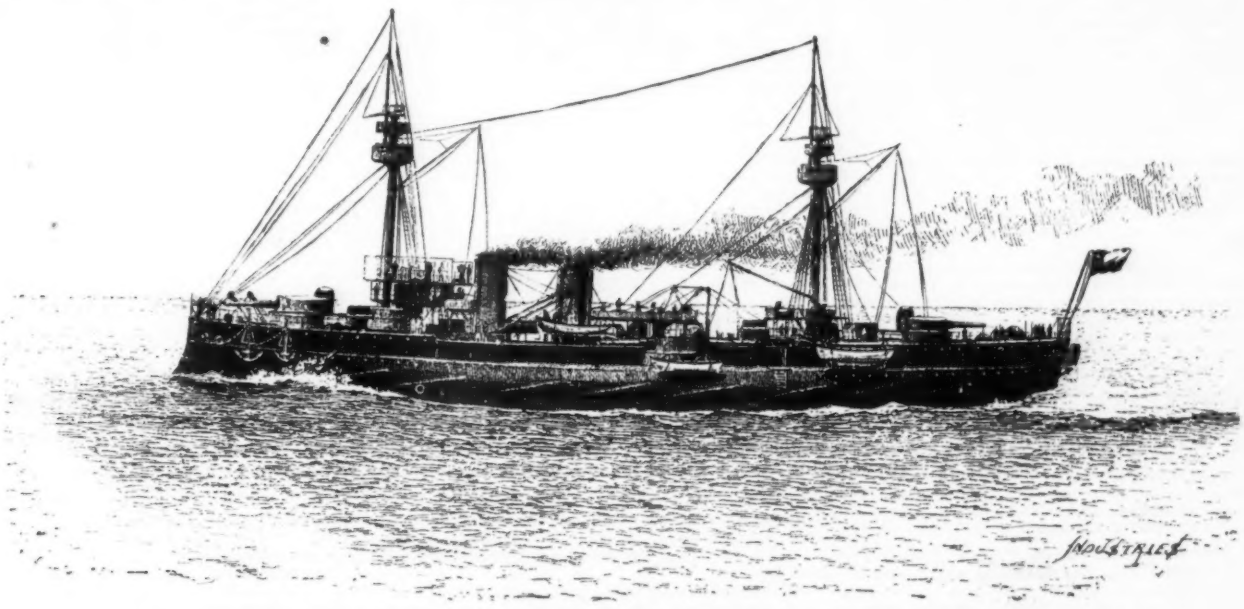
bria was saved, as well as other applications of the use of oil in taking on a pilot, etc. The oil is always applied from the outside of the boat from bags which are pierced with a strong needle, and filled with oakum which has taken up oil. It is possible to imagine a more perfect apparatus for distributing the oil more regularly. This crude system allows the drops to fall around the boat and forms a thin skin around it. This breaks the force of the waves and the vessel rides in comparative calm and safety. The amount of oil used is small, being about 10 liters of oil per sack each day. Our other engravings show the value of oil on the water in towing disabled vessels without danger of breaking the hawsers, and in shipping a pilot in heavy weather, which is not always a simple matter, when there is a strong wind and a heavy sea.—*Le Monde Illustré.*

## THE CHILEAN ARMORCLAD CAPITAN PRAT.

THE illustration below gives a general view of the armorclad Capitan Prat. The vessel, which has been recently completed by the Forges et Chantiers de la Mediterranée, La Seyne, for the Chilean government, is 328 ft. long, 60 ft. 6 in. beam, and 19 ft. 9 in. deep, and is constructed of steel. Motive power of 12,000 horse power with forced draught is supplied by triple expansion engines. The armament of the vessel comprises four 24 cm. Canet guns of 36 calibers, mounted on Canet gun carriages and inclosed in barbette turrets, eight 12 cm. Canet quick-firing guns of 45 calibers, four 57 mm. Hotchkiss quick-firing guns, six 37 mm. Hotchkiss quick-firing guns, and five Accles guns. Electricity has been adopted to a large extent as the motive power in the maneuvering of the guns and turrets. Three speed trials of the vessel have been carried out, the results of which are shown in the following table, the last trial being under forced draught:

| Duration of Trial. | Mean Speed, Knots. | No. of Revolutions. | I.H.P. | Coal Consumed per H.P. per Hour. |
|---|---|---|---|---|
| 6 hours | 17·42 | 104·18 | 8,498 | 1·34 lb. |
| 6 " | 17·825 | 110·591 | 9,684 | 1·575 lb. |
| 2¼ " | 18·315 | 118·17 | 12,150 | 1·575 lb. |

We are indebted to our French contemporary *Le Yacht* for our illustration of the vessel.




THE CHILEAN ARMORCLAD CAPITAN PRAT—GENERAL VIEW OF VESSEL UNDER STEAM.

## THE THEORY OF STORIATION IN ART.*

By HUGH STANNUS, F.R.I.B.A.

### § 1.—DEFINITIONS.

STORIATION is that section of the rules of Applied Art which governs (*a*) the Selection and (*b*) the Representation of Meaning in the decoration of objects.

The Selection will be treated of in §§ 4 to 8.

The Representation will be treated of in §§ 9 to 14.

The Meaning must be definite and intelligible. Much decoration consists of mere geometrical lines or brushwork without any direct meaning; and this is, of course, excluded.

The Objects may be anything, from a sculptured Building to a painted Chair-cloth, which can be made more beautiful by the aid of Art.

STORIATION, as being mainly Literary, lies outside the two great Artistic Virtues—Truth and Beauty.

Truth of imitation is first—the imitation of the forms around: the gathering of artistic detail.

Beauty is second—the selection and arrangement of the gathered detail of Line, Mass, and Texture, in pleasing combination, proportion, modulation, variety, etc.

Meaning is the third—the beautiful arrangement of truthful imitation having something added, beyond what they can give, which appeals to the Intellect, and tells a story.

The WORD is a new one, and the writer, who is responsible for it, recognizes the onus of showing—the necessity of an equivalent—the fitness—and the analogy with existing words.

This NECESSITY came when the early peoples began to record or tell stories on their Tent-cloths or Cave-faces, *i. e.* to show to whom these belonged.

As developed, there are seven branches included in the word:

Inscriptions, etc., the most simple.
Heraldry.
Symbolism.
Landscape painting.
Iconography.
Portrait painting, and
Historic painting, the highest.

The same man or woman might do all these, but we are justified, by the Division-of-labor in Art, in regarding them as separate.

The two often used words: "Iconography" and "Symbolism"—cover only one half the ground. Historic paintings, such as Sir Frederick Leighton's at South Kensington, or those in the corridors of the Houses of Parliament, are nether Iconographic nor Symbolic (except in a very far fetched sense), and neither are the names of potters and potteries—which are yet part of the decoration in the Keramic Gallery at South Kensington. Heraldry, which is often the only clew to authorship and date in Architecture, is (by reason of giving information) a branch of Storiation; but it lies outside of the two often used words. Hence the necessity for one single, comprehensive, term for the whole.

The FITNESS will be perceived in the following:

The ANALOGY will be seen on reading, in Harrison's "Description of England," 1580:

". . . only the stories in the glass windows excepted;"

in Milton's "Penseroso," 1637, line 159:

"And storied windows richly dight,
Casting a dim religious light"
. . . . ;

and in Gray's "Elegy," 1749, line 41:

"Can storied urn or animated bust
Back to its mansion call the fleeting breath."

### § 2.—DIVISIONS.

There are three mental stages in the process of storiating an object:

The PURPOSE, or function for which the object is intended, will be ascertained, § 3.

Those IDEAS, associated directly or collaterally with the Purpose, which are capable of artistic expression, will be considered, § 4.

Those METHODS, of representing the Ideas, which are technically possible, will be selected, § 9.

### § 3.—PURPOSE.

The PURPOSE of the Object is not at the Artist's choice. It is one of the data of his work; and it (generally) determines the treatment.

### § 4.—ASSOCIATED IDEAS.

In considering IDEAS: the storiationist may either dig deeply or dig widely. He may search back, far into the Past, and show the evolution of the particular subject, in its direct descent; or he may survey widely in contemporary manners and customs, and show the cognate subjects, in collateral descent.

Thus, in a THEATER, the storiation might trace the Evolution from the old Greek Tragedies, which were religious and patriotic functions, with Fate and controlling Power involved in their action—through the Comedies, no longer religious but for class amusement, in which the Gods were ridiculed and relegated to the background while human craft and passion constituted the weft of the fabric—through the Miracle plays of the Middle Ages—the Moralities of the Renascence—the Plays of the Shaksperian cycle—down to the Comedy-of-Manners of the present day.

Or, on the other hand, the contemporary varieties of the art: Symphony—Oratorio—Opera—Passion play—History—Tragedy—Comedy—Pantomime—as they are modified and mingled in various countries, might be exhibited.

These two directions, in which the ideas are sought, will perhaps impress upon people the fact that they are not isolated; but links in two Chains, one reaching back to the past beginnings of things, and the other by community of Art joining all present existences, and so forming that net of sympathy which incloses all.

### § 5.—GROUPS OF IDEAS.

The ideas connected, directly or collaterally, with the purpose of an object are innumerable; and it is impracticable to set them down in order; but they may be divided into groups as follows:

(*a*) Those which are appropriate to the purpose (see § 6).
(*b*) Those which are incongruous (§ 7), and
(*c*) Those which are indifferent (§ 8).

An instance might be seen if, to choose a homely one, an embroidered Seat cushion were to be decorated with the imitation of: (*a*) Moss and Violets, (*b*) a Bird nest with Eggs, and (*c*) Bows and Quivers, and Garlands. And the same picture, *e.g.*, of Water with lilies, might be appropriate, incongruous, or indifferent, according as it was applied to: (*a*) A Splash-cloth, (*b*) a Chair-cloth, or (*c*) a Table-cloth.

Some further illustrations of Ideas and of methods are given; but it should be observed that they are offered, not as Examples to be followed in all cases, but, as Instances which are near at hand to a dweller in London. There is much storiation in the Exhibition buildings at Chicago, judging from the interesting description by Sir Henry Wood in the *English Illustrated Magazine*, and there is some in the details of the "Griffin" monument; but the former is distant, and the latter is somewhat unworthy.

### § 6.—APPROPRIATE IDEAS.

CHURCHES have always been places for the decoration of which the people brought of their best; and the decoration always had meaning. In fact, the Stories were painted or carved, for the purpose of Teaching, long before it was realized that they contributed toward the Beauty of the whole. And each place in the Church had its special set of subjects which would affect the worshiper more appropriately or more strongly there than in any other.

The Portal, by the sculptures, reminded him of the Presence into which he was about to enter, and of the Heavenly Host which surrounded him.

The Baptistry, through the Twelve Apostles as witnesses to the Faith, reminded him of the necessity to keep it pure.

The Nave, with its Old Testament or Pre-Christian History, showed the times of Preparation.

The Chancel, with the life of Christ, showed the times of Revealing.

The Apsis, with the figure of the bidding Saviour, invited him to come.

The Cupola, with its display of the Resurrection and Triumph of the Saviour, assured him of Blessedness.

The Wall of Exit, with its Judgment scenes, warned him of Responsibility.

These are some of the Ideas which were portrayed; but they were often varied; and a complete collection of the various Schemes of Storiation, properly indexed, would be of great use.

The Windows, or eyes of the Church, have always been a favored place for Storiation. In these are opportunities for the Heavenly Hierarchy, the Angelic Chorus, the Bible Persons, the Teachings of the Lord, the Local Hagiology, etc., and, as they are often given as Memorials, some personal allusions are admissible.

The Pulpit might be treated in consonance with Paul's advice: "Preach the word . . . reprove, rebuke, exhort . . . " (2 Tim. iv. 2); or, as in that at Pisa, erected at the time when the Preacher had become important, with the so-called "Liberal Arts:" Rhetoric, Arithmetic, Geometry, Music, Astronomy, Philosophy, Grammar, and Dialectics—grouped round the central support, as handmaids to the chief sister Theology.

For the Choir, when separated from the Chancel, a fine idea may be taken from the successive invocations, of the Canticle, "O all ye works of the Lord, bless ye the Lord; praise Him and magnify Him for ever," with its grand crescendo from the Natural phenomena, through the Animals, and Man, up to the Spirits of Just men made perfect—"O *all* ye works of the Lord, praise Him and Magnify Him for ever." The "Te Deum" has been used here; but it should be observed that—"laudamus Te" is only in the preamble. The hymn is really a prayer—"We therefore pray Thee help Thy servants"—and as such, it would be more appropriate in the Nave, where the people sit.

The LOCAL-CULT—of the Patron Deity, Patron Saint, or Collegiate Body, has always been a strong power in

* Lecture before the Society of Arts, London, January, 1893.—From the *Journal*.

storiation. Two instances, from the Acropolis at Athens, and the Vatican Palace at Rome may be given.

At ATHENS, to the old Greek, the great statue of Athene was the guardian deity of his city and nation. She was the "Pro-machos"—the fighter in front—like the great Twin brethren of the Romans, sung by Lord Macaulay. The mariner saw her helmet as he rounded the promontory; and felt she was also the guardian of himself as much as of his nation. The chrus-elephantine work of Pheidias, within the shrine, was dedicated to the same goddess—as "Victory bringer;" and all around—on the Peplum, the Pediments, the Panathenaic frieze, or the Metopes—told the Stories of her or of those other deities about whom Miss Harrison has unraveled the myths in so delightful a manner.

At ROME were the headquarters of that vast ecclesiastical organization which sought to formulate and spread the faith of the Galilean Fishermen until it should be universally accepted. The head of this—the Father of the faithful—was wont to receive the Ambassadors from other States in the *Sala Regia*; and this was appropriately decorated to show the victories or triumphs of this Church over those who had differed from or opposed it. Thus—the humiliation of the Emperor Henry IV., by the Pope Gregory VII., in 1077—the humiliation of the Emperor Frederick Barbarossa by the Pope Alexander III., in 1177—the return of the Pope Gregory XI. from a semi-subjection at Avignon to independence at Rome, 1377—the defeat of the Moors at Tunis in 1553—the defeat of the Turks at Lepanto in 157?—the overthrow of the Huguenots at the massacre of St. Bartholomew's, in 1572—each represented in a large picture, had a lesson to convey to those Envoys from the foreigners, the moral of which was not far to seek. Two of the *Stanze*, which are approached from the Loggia of Rafaelle, on the same floor, have similar significant storiation: The *Sala di Constantino* shows the Victory, and the Baptism of the first Christian Emperor, and his Address to his army, and also his Donation (of the city of Rome) to one of the Popes; the *Sala d' Eliodoro* shows the Expulsion of Heliodorus from the Temple, the Repulse of Attila from Rome by the Pope Leo I., the Liberation of St. Peter, and the Conversion of the skeptical German Priest; all of which would be food for thought on the part of opponents, in demonstrating the venerability, the far reaching power, and the benevolent intentions of the Keepers of the Faith.

HISTORIC MONUMENTS must, of necessity, be storiated. The Trajan Column, at Rome, records the campaign in Dacia. The Vendome Column, at Paris, records the campaigns in 1805. The Arch at the top of the Champs Élysées, at Paris, records other Napoleonic campaigns up to and including the battle of Ligny in 1815. The Ideas in this appear to have been generally, a glorification of the destructive arts, with representations of Incidents in the campaigns, and of the Spoils taken from their enemies.

PERSONAL MONUMENTS are also often storiated. The Ideas, associated with Monuments, have been well classified by Mr. C. Daly under the three heads of:

DEATH—or those connected with the sense of the Loss of a friend, of the Silence of the tomb, and of the Decay of the body.

GLORIFICATION—or those connected with the personal Appearance, with the Virtues, the abilities or tastes—and

FAITH—or those connected with the teachings of Religion, and the belief in Immortality.

The first of these deals with the old Pagan "Properties"—of the inverted Torch, the Winding sheet, and Skull and Crossed-bones.

The second informs us what particular Virtues the deceased favored, or wished to be thought to practice, as in the monument, erected by Can Signorio della Scala, for himself, at Verona, after he had murdered his brother, which bristles with twelve statues of selected Saints and Virtues. A more worthy instance is the monument to the late Prince Consort in Hyde Park, which shows a Portrait statue, and alludes to his generous and discriminating encouragement of the Arts and Sciences, and the international character of his sympathies. Personal tastes are shown in the fine Frieze round University Hall, Gordon Square, to the memory of Henry Crabb Robinson, which collects, as in a conversazione, some of the men and women he knew. Another instance is seen in the memorial to Professor Fawcett, intended by Sir Henry Doulton for Vauxhall Park. There is a Portrait statue, with a figure of Victory behind; and in the panels of the pedestals are subjects appropriate to his character—Courage, Sympathy, Justice, and Truth; and to his work—Good News, Bad News, a Woman postal clerk, and India.

The third group of Ideas is more consonant with our feelings in England; and instances will occur to every one who gives attention to the subject. We English are reticent in feeling, and object to spend on sentiment that which may be better used for benevolence; and our climate is not favorable to hypæthral sculpture; but a walk through a Cemetery is instructive.

SOCIAL LIFE AND CIVILIZATION often give Ideas. Some of these are effectively worked in at some of the Mairies or official centers of the districts of Paris. It is there that Marriages are solemnized, that Births are registered, and that the Conscription lists are prepared of those on whom their country has claims for duty.

The decoration in that of the 13th district by M. Boulanger is in a classic style; and shows on the four walls, the four Ideas of: —Marriage —Manhood — Family life —Patriotism.

The Hotel de Ville, which was destroyed during the second siege of Paris, contained, in the twenty-eight cove-panels of the great Hall, a History of civilization. As these were so complete in arrangement, a list of the subjects is here given, with translations of the Latin mottoes:

1. Mother Nature—"The race of men arises."
2. Contest with Animals—"He fights against the wild beasts."
3. Shepherd life—"He holds the flocks in his hand."
4. Early metal working—"He is pressed by various labors."
5. Spinning and Building—"And they prepare clothes and houses."
6. Slaying a Ram—"The gods are appeased with a sacrifice."
7. Cornfield—"The harvest enriching the husbandman."
8. Use of the Vine—"He dissipates his troubles."
9. Music—"Songs harmonize with the lyre."
10. Astronomy—"He marks out the months and the stars."
11. Navigation—"He sends out ships on the sea."
12. Steam—"Force more intense from confinement."
13. Drama—"The two faced mask weeps and laughs."
14. Metaphysics—"Man in intellect approaches deity."
15. Theology—"Instruction confirms faith."
16. Physics—"He seeks the causes of things."
17. Justice—"The goddess avenger of crimes."
18. Government—"Authority administering affairs well."
19. Geometry—"He measures everything in the world."
20. War—"Thus cruel wars assail."
21. History—"Clio singing of heroic deeds."
22. Medicine—"Diseases are cured by the physician's art."
23. Benevolence—"Charity is the nearest to God."
24. Oratory—"He rouses, he delights, he teaches."
25. Fine Arts—"The three arts flourish as one."
26. Choral dance—"A dance to the sounds of a flute."
27. Agriculture—"Abundance scatters her fruit."
28. Fame—"She shows the way to the stars."

TEXTILE OBJECTS, *e.g.* Curtains, etc., seem to invite allusions to: —Arachne, the ambitious embroiderer—Penelope, the faithful wife—Dorcas, the benevolent widow—or that unfortunate Lady of Shalot—among others.

FIRE PLACES invite:—the Plutonic cycle—Hephaistos and the Kuklopoi—King Alfred and the Cakes—the "Golden Milestone" of Longfellow—and many other pleasant ideas to the home-loving Englishman.

DRINKING FOUNTAINS need not always show us heathen Nymphs, aquatic Plants, and Dolphins; but may represent:—Abraham's messengers—David with the dearly procured water—the Samaritan well—Sir Philip Sidney—or the big Sister of to-day lifting her little sister to have a drink—etc.

In thus interweaving the Ideas with the Decoration—there will be a leading out of the mind by the associations—an interweaving of the interesting with the commonplace—a connecting of the lesser with the greater—a looking from the lower to the higher—which it is the privilege of Poetry to add to Life; and which Storiation adds to life's Surroundings.

### § 7.—INCONGRUOUS IDEAS.

The writer leaves this invidious portion of his subject—unwritten.

### § 8.—INDIFFERENT IDEAS.

Some PURPOSES of objects are so indefinite or uninteresting, and their associated Ideas are so commonplace, that these are passed over; and the storiationist arranges some scheme which, though not suggesting the Purpose, is yet *not incongruous*. An instance exists in the Refreshment room at the South Kensington Museum, where the beautiful panels by Mr. E. J. Poynter, R.A., show the 12 Months and the 4 Seasons instead of such subjects as would, though appropriate to a Grill room, be commonplace and unelevating. On buildings and other objects, which are indefinite, the following may be used: Bible History, always—Local History and Tradition, often—and Seasons and Times, generally.

BIBLE HISTORY is universal in every time and country, from those grand Byzantine Gates and Frontals, onward.

LOCAL HISTORY instances are so plentiful, that:—the history of Manchester by Mr. Madox Brown, in the Town hall of that City—the "Chevy Chase" by Mr. W. B. Scott, at Wallington in Northumberland—and the "Dragon of Wantley" by Mr. E. J. Poynter, at Wortley need only be referred to.

SEASONS and TIMES are shown at South Kensington (as before mentioned).

THE LIFE OF MAN is pathetically shown round the drums of the terra cotta Columns, by Godfrey Sykes, in front of the Lecture Theater at South Kensington. These have been so fully described by Mr. Pollen that no more need be said than to refer to his pamphlet on the subject.

BESTIARIES are found in many places:—Westminster Chapter house, and the great Hall at Padova, being instances.

The LITERATURE of a country will furnish a perennial supply for this group; and all workers in Decorative Art feel a debt of gratitude to their brother Artists in this, for their inspiration.

### § 9.—METHODS OF REPRESENTATION.

The METHODS, by means of which the associated Ideas are represented, may be divided into Groups as follows:—

I. Imagination (including in that division all Poetic and Abstract renderings).
II. Reality (the representation of Facts that have been or are).
III. Epigraphy (not representation by Picture but by Word).

These GROUPS are further subdivided, according as the Methods are treated, as follows:—

A. Mythically, including under this sub-group such as are:—(1) supernatural, (2) not in ordinary experience, (3) not situated in our own globe, (4) involved in prehistoric obscurity, (5) the creation of Poets and other "makers" of literature, and (6) the personifications of abstract Ideas.
B. Historically, *i.e.*, in a "matter of fact" manner, with no meaning beyond that which is shown on the surface.
C. Typically, *i.e.*, such as are selected because they show the desired characteristic in a greater degree than others.
D. Symbolically, *i.e.*, such as have another or inner Meaning, beside or beyond that which is apparent at first sight.

The complete List of Methods is shown in the Table, § 10. It should be here observed that it has not been always possible to classify logically; and some methods are grouped by affinity rather than by evolution.

### § 10.—TABLE

*of the 22 Methods of Storiation, by means of which Ideas are Represented in the Decoration of Objects.*

Storiation.
- I. Imagination
  - A. Mythic: *a.* Episode. *b.* Personage. *c.* Locality.
  - D. Symbolic: *d.* Attribute. *e.* Device, etc. *f.* Heraldry. *g.* Color.
- II. Reality
  - B. Historic: *h.* Event. *i.* Person. *j.* Place.
  - C. Typic: *k.* Occupation. *l.* Worker. *m.* Scene.
  - D. Symbolic: *n.* Action, etc. *o.* Instrument. *p.* Result.
- III. Epigraphy
  - B. Historic: *q.* Name (only) of Event, Person or Place. *r.* Word (only) for Idea. *s.* Date (only) of Event.
  - D. Symbolic: *t.* Allegory, etc. *u.* Motto, etc. *v.* Letter, etc.

### § 11.—DETAILS OF METHODS.

(*a*) The EPISODE, from Myth or Poetry, is used when no suitable Historic Events can be found which will represent the desired idea.

Instances of the Mythic Episode are seen in:—the "Orpheus singing" of the Meeting room frieze at our Society's House—etc.

(*b*) The PERSONAGE, *i.e.*, Ideal Portrait, includes such as are classified in the six divisions of group A in § 9, *e.g.*, Gods and Goddesses, and the personification of the Virtues, Elements, Planets, Arts, Sciences, etc.

Instances are seen in:—the "Thames" of the Meeting room frieze—the "Fortitude," "Faith," "Charity" and "Justice," of the Gordon Monument—the "Britannia" of the bronze Coinage—the Figures on Sir F. Leighton's Jubilee Medal—etc.

(*c*) The LOCALITY, *i.e.*, Ideal View, includes such as are mentioned in § 9.

Instances are seen in:—the "Elysium" [and "Hades"] of the Meeting room frieze—etc.

(*d*) The ATTRIBUTE is the representation of an object which has been *given up* to a certain use, so that, on seeing it, the association of its user or usage arises in the memory. The Garland of Fruit, which was hung about the Altar and the Victim, as also the Patera, Vase, and other sacerdotal appliances, when represented on the Roman Temples, thus suggested their religious Ritual. So also other objects in consequence of their association with their particular Gods and Goddesses came, in time, to suggest them; thus the Eagle and Thunderbolt of Jupiter, the Lyre and Laurel of Apollo, the Aigis and Owl of Minerva, etc. Afterward to suggest the Character or Quality; thus the Eagle for Majesty, the Laurel for Peace, the Owl for Wisdom. When iconographic Hagiology was crystallized, in the middle ages, the representations of Martyrs included the Instruments which were associated with their martyrdom, *e.g.*, the Flaying knife of Bartholomew, the Wheel of Catherine, etc.; or with some other event, *e.g.*, the Keys of Peter, the Serpent chalice of John, the Giant form of Christopher, etc.; or some Companion, *e.g.*, the Stag of Hubert, the Assyrian monsters afterward adapted from Ezekiel for the Evangelists, the Pig of the Paduan saint, etc.

The authorities on this subject are:—Durandus, Ripa, Didron, Mrs. Jameson, etc.

Instances are seen in:—the Scales and Sword of Justice—the Anchor of Hope—in many churches, etc.

(*e*) The DEVICE is the representation of a scene or object. Those on the shields of the "Seven Chiefs against Thebes" are minutely described by Aischulos (d. 456 B.C.): three of them were accompanied by Mottoes; but these latter were not an integral part of the Device.

The EMBLEM was a short Verse or motto, with an explanatory Picture.

The IMPRESA, as adopted by the renascence Italians, on *undertaking* any adventure, was a small Picture, with an explanatory motto.

These two latter were so similar in their result—the picture and the motto—that the words came to be used synonymously.

The authorities on this subject are:—Alciati, Giovio, Ruscelli and Bargagli; followed by Cats, Quarles, Whitney, etc., down to our own venerable member, Mr. John Leighton.

Instances are seen in:—The "Cave Canem" picture from Pompeii—many Printers' marks—many examples of the recently revived "Ex Libris" taste—etc.

(*f*) The HERALDIC SHIELD is well known, and need not be particularized.

Instances are seen in:—The Royal shields on Westminster Bridge—those of the four kingdoms, together in quarterings or separate, on the Houses of Parliament—etc.

The HERALDIC BADGE is (1) a charge taken from the Shield, (2) the Crest taken from the Wreath and used independently, *e.g.*, the Porteullis, Feathers, etc.; or (3) Objects taken not from bearings but from any other convenient source, *e.g.*, the sprigs of Broom, Rose, Shamrock, etc., in the caps, or the knotted cord on the coats of retainers.

Instances are seen in:—much of the carved enrichments of the Houses of Parliament.

(*g*) The SYMBOLIC COLOR was more used in the middle ages, though the revival of stained glass during the last twenty-five years has drawn attention to it.

Instances are given in Chap. III. of Professor F. Edward Hulme's interesting work on the Principles of Ornament.

(*h*) The EVENT is the representation of an actual occurrence in Local or National History.

Instances are seen in:—The "Victors at Olympia" of the Meeting room frieze—the Capture of Acre, and the Forgiveness of the Chaluz archer, in the Richard I. pedestal panels in Palace yard—the Pictures from the Civil War, in the Houses of Parliament—etc.

(*i*.) The PERSON, *i.e.* a known individual, shown by a Portrait, is used singly or collectively.

Instances are seen in:—The statues of Artists in front of the Royal Academy—the mosaics round the Loan court at South Kensington—etc., for the former treatment; and in the Crabb Robinson frieze at the University Hall—the Podium of the Albert Monument—etc., for the latter.

(*j*) The PLACE, *i.e.*, the View of a particular Town or Country, is represented by:—Inhabitants, as in the "Harmony welcoming the Nations," by Lameire—Views, identifying it by well-marked natural surroundings, *e.g.*, Naples by Vesuvius; or by well-known buildings, *e.g.*, ancient Rome by the Coliseum or modern Rome by St. Peter's, or by Maps, *e.g.*, in the Vatican gallery.

Instances of this in London are not known to the writer.

(*k*) The OCCUPATION is represented by figures engaged in such as suggest the required Idea.

Instances are seen in:—the Industrial Arts of Peace and of War, at South Kensington—the Arts and Sciences in the Albert Hall frieze—etc.

(*l*) The WORKER is not individualized as a portrait, but represented by the typical Craftsman, clad in his Working clothes, with his characteristic Tools and Specimens of his Craft.

Instances are seen in:—the Figures, typifying the chief Livery Companies of the City of London, in the Guildhall Council chamber, etc.

(*m*) The SCENE, *i.e.*, not any particular Place, but a generalization of Climatic character, is represented by:—Inhabitants, as in the actual Place—the Flora, *e.g.*, the Torrid, Temperate and Arctic Zones, by the Palm and Cactus, the Oak and Grass, the Fir and Moss—the Fauna, *e.g.*, the above by the Lion and Crocodile, the Horse and Otter, the White Bear and Seal.

Instances of this, in London, are not known to the writer.

(*n*) The SYMBOLIC ACTION is a Dramatic rather than a Graphic Method of Expression, and it is included here only to complete the classification. It is more used in the early stages of language than when they have become perfect and flexible means of communication.

Instances are given in Chapter II. of Professor Hulme's book before mentioned.

(*o*) The INSTRUMENT is such as is commonly used in any Occupation, represented singly or in groups or trophies, *e.g.*, the Palette and Brushes of Painting, the Telescope, Retort, Pulleys, etc., of other Occupations, etc.

Instances are seen in:—the Trophies of Tools hung on each side of the Exhibition certificate, which is used as a frontispiece to the book—"Alfred Stevens and his Work," lately published.

(*p*) The RESULT is the effect of the Worker using his Instruments to produce objects of Art, etc., gather Food, prepare Shelter, capture Arms, etc.

Instances are seen in:—the paintings of Silversmithery in the Loan court at South Kensington, the reliefs of Indian and French Arms on the Wellington Monuments, etc.

(*q*) The NAME is used singly or in series, to represent Event, Person or Place, when the position or means require such extreme simplicity.

Instances are seen in:—the Victory tablets round the Wellington Monument, the Potters round the columns in the Keramic Gallery at South Kensington, the Potteries in Frieze of same gallery, etc.

(*r*) The WORD for an Idea, singly or in series, is used under similar circumstances.

Instances are seen in:—the words "Agriculture," "Commerce," etc., recording the branches of our Society's Work, in the Meeting room cove, etc.

(*s*) The DATE is useful, among other purposes, in recording the erection or completion of Buildings, etc.

Instances are seen in:—many Public Buildings in London, though not so universal as they should be.

(*t*) The ALLEGORY (including in this the Parable and Fable) is a Literary rather than a Graphic Method of Expression; and is included here only to complete the classification. Its Function in literature is analogous to that of the Symbol in art, *i.e.*, to *speak otherwise* than by the mere primary meaning of the word or objects. Thus the "Pilgrim's Progress" is an Allegory; and the "Catherine Wheel" is a Symbol.

(*u*) The MOTTO (including in this the Proverb, etc.) is used under similar circumstances as the other methods in this Group III. It is the most direct method of telling a Story, but its interest is mainly literary: the Artistic value depending on the decorative appearance (or otherwise) of the Alphabetic characters, *e.g.*, the Cufic letters in the Alhambra inscriptions.

Instances are seen in:—the Quotation from Spenser in the Octagon-room of the R.A.—many Sword-blades—the "Waste not; want not" of the Bread-platter—etc.

(*v*) The LETTER is the most simple; but it is not without its symbolic value.

The MONOGRAM, in its earlier style of conjoined letters and its later style of interlaced ones (ciphers), has been very useful to the Antiquary.

The SIGN, conventionally degraded from picture writing, used for the Planets, Zodiacal Constellations, Metals, Alchemic Decoctions, etc., has interest and value.

The REBUS, or substitution of representations of *things* for the proper name, is of great help to the Antiquary; and may be classified in this group.

Instances are seen in:—the Alpha and Omega—the Chi-Rho—the Ciphers on Railway carriages—the chemist's Show bottles—many old Monasteries—etc.

### § 12.—COMBINATION OF METHODS.

These METHODS have been sometimes combined:—the attribute included in the representation of the Personage—the Person in the Event—or the Result (*e.g.* the trophy of game) with the Instrument (the fowling piece).

The MYTHIC has been combined with the Historic in some of our Monuments, where the Neptunes and Sea-divinities support the English Captains, the figures of Fame crown the dying Generals, or the Skeletons are throwing darts or grasping at the fainting ladies.

MYTHIC PERSONAGES have been also substituted in representing historic events. The crossing of the river Rhine near Nimeguen, by the French King Louis XIV. in his attempt to conquer a portion of Holland, took place in 1672. At the palace of Versailles, near Paris, this event is represented as follows:—a man, presumably a portrait of the King, drives a chariot toward the ..H. side of the picture, and threatens some figures there with a "thunderbolt;" the chariot is pushed from behind by Hercules, who is also striking with his club at an old man who sits on the ground with an overflowing urn, representing the river; Phœbus lights the chariot, and Minerva guides the driver; while several winged females (in the air) are carrying chaplets and palm leaves, and blowing trumpets. The whole is an instance of the treatment of Reality as if it were imagination.

The series of the History of Maria de' Medici, in the Louvre, also shows the mixture of Mythic-personages with Historic-persons.

### § 13.—OVERLAPPING IN REPRESENTATION.

Sometimes in an Object the same person may occur twice.

Thus in the Albert Monument, Michelagnolo is represented on the West side among the Sculptors, and on the East side among the Painters.

Similarly, in the storiation of a church, if the Evangelists are separated from the Apostles, as is generally done, John and Matthew will be represented twice. So also with any Person who is known in two characters.

### § 14.—DUPLEX STORIATION.

DOUBLE REPRESENTATION of the same Idea is often found in Mediæval Storiation.

TWO BOOKS, published very early in the middle ages—the "Speculum Humanæ Salvationis" and the "Biblia Pauperum"—both give events from the New Testament history, each accompanied by other events in earlier history, with inscriptions, in what is known as the Type and Antitype manner. They are very systematically worked out, showing the evidence of much time having been spent upon them; and these, which were doubtless Handbooks to the artists of the time, accustomed people to pictures of the N.T. history with the earlier events represented in the backgrounds; and thereby made the storiation more interesting.

AN ANALOGOUS TREATMENT was followed in the Passion play at Ober Ammergau, during the Last Supper, when parallel scenes—of the Israelites gathering manna, and of Melchizedek offering bread and wine—were shown as *tableaux vivants* in the background, while explanatory words were chanted by the chorus.

Mr. WALTER CRANE, who has done so much for decoration and for artistic books in England, has adopted the above expedient very charmingly in his books:—"Bluebeard," where behind the tempted Wife with the Key is shown, on a curtain, Eve with the Apple—"Puss in Boots," where at the marriage feast is shown, on the tapestry, the other Cat that killed the Rat—"Frog Prince," where is shown, on the tablecloth, that other Frog who would a-wooing go—and in "Beauty and the Beast," where is shown, on the harpsichord, the Beasts charmed by Orpheus.

### § 15.—AVAILABLE SPACES.

The number, size, and proportion of the available Spaces will always govern Storiation; and of this, the Artist will be the best judge.

In connection with this, an amusing instance of a space being too large, is on record. It was stated that at Washington the painting of the grand historic Frieze was brought to a standstill, as there was "not enough history to go round;" so, it was said at the time, they would have to wait until they had made some more history.

### § 16.—INTERNATIONAL SELECTION.

In the choice of Persons or circumstances to illustrate any idea it is well to remember; that human achievement belongs to no one country; and to select the most representative men and women regardless of nationality; thus making the idea truly international. The storiation that, while including some very second rate French authors, could ignore Shakspere and Milton, may be prompted by patriotic motives; but can only have a cramping effect on the intelligence of the inhabitants. It is pleasing to observe, in the statues on Pennethorne's University building, that, of twenty-two great men, twelve are of other nations, from Plato and Galen to Cuvier and Linnæus; and so, also, in the great Artists in the podium of the Albert Monument.

### § 17.—DIDACTIC USE.

It is further useful in teaching. Paulinus, a bishop of Nola in the V. century, as quoted in Didron (Bohn's edition) I. 4, and Geoffrey, a bishop of Auxerre in the XI. century, as quoted *Ibid.* I. 5, both give reasons which are interesting. Dante in the Purgatorio gives two instances of this Didactic value:—

In Canto X. 28 to 51, a marble relief, showing humility toward superiors, by Mary; in line 52 we read further—"*Un' altra storia nella roccia imposta*" which shows humility toward equals, by David; and in line 70 we read he moves his feet to examine another "story" which shows humility toward inferiors, by Trajan. When we know that these Sculptures are in that circle of the Purgatorio in which the sin of Pride is punished—their appropriateness is apparent.

In Canto XII. 25 to 72 we read of another Marble showing instances of humbled Pride, from Satan to the destruction of Troy; and he gives as the purpose of these stories—"*Si che veggiate 'l vostro mal sentiero.*"

In the Palazzo Pubblico at Siena is a very interesting Fresco showing the results of Good and Bad Government, as in an antithetic parable.

And as a last instance, that which is the most beautiful of all, may be seen the noble ruin of Lionardo's in that Refectory where as often as the Brothers met together they were reminded to—"do this in remembrance of Me."

### § 18.—EMOTIONAL VALUE.

It is found that Pictures excite the multitude more than Writings, partly by association and partly by being more quickly intelligible.

The celebrated Italian, NAPOLEONE BUONAPARTE, who was for some time Emperor of the French, gave an interesting instance of this when he was contemplating the invasion and Conquest of England in 1805. He caused the Bayeux Tapestry to be removed and exhibited at Paris, with a view to stimulate the passions of his subjects to attempt once more that conquest which the Tapestry showed had been so easily accomplished before by William of Normandy.

It is also related that RIENZI, the unfortunate political Reformer of the XIV. century, commenced his appeal to the people of Rome by exhibiting, in various public places, Pictures of the degradation of the city, on which he made speeches.

### § 19.—HISTORICAL VALUE.

This is one of the most important branches of the subject, requiring much space to show even the mere outlines of the ground to be covered. The Ideas which were chosen at various periods would form an interesting chapter of Storiation; but it can be only mentioned in this paper. And now that Archaiology is becoming, as an exact science, a worthy and necessary sister to History—this chapter is being written, and is yielding the most interesting and valuable results.

### § 20.—NECESSARY KNOWLEDGE.

In the PREPARATION of a complete scheme: the necessary knowledge will be seen to be great and wide. The Storiationist must know somewhat of many things; and also of the places where further knowledge is to be obtained.

Hence: the scheme has often been prepared, not by the Artist, who executed the work, but by the Learned man (Priest, or Scholar) who alone had the grasp of the threads constituting the warp of their knowledge.

But the technical processes of artistic expression most always be considered; and some subjects, *e.g.*:—the Isolation of Oxygen, by Priestley—the Observation of the Transit of Venus, by Horrocks—the Identification of Lightning, by Franklin—which are easy in Painting or Relief, present great difficulty in Statuary; so also other subjects, *e.g.*:—a Fight for a Standard—or a Football scrimmage—are more clearly understood in isolated Statuary groups than in flat presentment. Therefore the Artist who is to execute the work must be allowed (in consultation) to choose the exact treatment which inspires his mind. The choice of Ideas is mainly Literary; and that of Methods mainly Artistic. The Storiationist may select the Ideas in consultation with the Artist; and the Artist should determine the Method of representation in conjunction with the Storiationist.

In DECIPHERING storiation: much knowledge of the Mythologies and Histories of all Peoples is also required.

That of the Greeks and Romans has long been a part of School curriculum: that of the Egyptians and Assyrians is a part of the equipment of Archaiologists.

That of the Hindu nations has been condensed into an admirable Handbook, by Sir George Birdwood, which explains much of the Hindu art that before was involved.

Mr. James L. Bowes, in the Notes at the end of his beautiful book—"Japanese Pottery" (Liverpool, 1890)—has done the same good service to the student of Japanese Decoration. When the beginner learns how every Plant and every Attitude of the plant, as also every Animal has a symbolic meaning—that, when one gentleman presents a picture of the Pine tree, Bamboo, and Plum tree to another, he is wishing him good fortune and promising eternal friendship—he will judge the work for its value *symbolically* as well as aesthetically; and much that is puzzling in their distribution or arrangement, now, will be then made clear.

### § 21.—READING THE STORIATION.

The purpose of a building may often be shown by its exterior decorative sculpture or mosaic.

The Classes of buildings may be determined, generally, by the architectural treatment of the Roof and of the Doors and Windows. Thus—Museums, Hospitals, and Factories—all show their class; but the particular kind of—Object, Disease, and Manufacture—is not shown by the exterior Architecture; and can only be ascertained when Sculpture assists by Storiation.

It does for Architecture that which words do for Music. Music and Architecture suggest; but Words and Storiation can also describe, and inform. Hence the value of Storiation when appropriate Ideas are shown. An example is seen in the large building, on the west side of Whitehall, which contains the Home and Foreign Offices. Each division of the building has seven spanrail panels with low-reliefs of mythic personages, below; and six circular niches with busts of historic persons, above.

In the Home office the order is:—

| (Spanrails.) | (Niches.) |
|---|---|
| Law, | Gascoigne, |
| Agriculture, | Sinclair, |
| Art, | Reynolds, |
| Science, | Bacon, |
| Manufacture, | Watt, |
| Commerce, | Smith. |
| Literature. | |

In the Foreign office the order is:—

| | |
|---|---|
| Government, | Elizabeth, |
| Europe, | Drake, |
| Asia, | Livingstone, |
| Africa, | Wilberforce, |
| America, | Franklin, |
| Australasia, | Cook. |
| Education. | |

This is not the occasion to speak of the splendid sculptural qualities of the sitting figures in the spanrail panels; but the thoughtful manner, in which the details are worked out, is well worthy the attention of the passer-by; and the introduction of the Ideas of Government and education seems to suggest that Great Britain realizes its duties toward the foreign possessions. But the chief point is—that the thoughtful spectator recognizes the Purpose of each division of the building.

It is pleasing in this connection, to see the spectators round the Albert Monument purchasing the penny Book which gives details of the persons represented; thus Storiation is incentive to Study; and gives interest in proportion to the Knowledge of the beholder.

### § 22.—THE CENTRAL IDEA.

All pictures in Monumental Decoration should be ar-

ranged in connected Series, or sets. The impressiveness of a number increases—like the examples in Natural Philosophy—in square ratio.

If we view *one* picture—say of John Howard visiting a Lazar house—we may observe a man accompanied by a number of officials in a horrible place with a great quantity of human suffering. But if we contemplate a Series of pictures—another of Elizabeth Fry seeking to reclaim the poor women in Newgate; and another of Florence Nightingale nursing the sick and wounded at Scutari—then we observe amid the varying circumstances of the Russian lazaretto of 1789, the English gaol of 1820, or the Turkish hospital of 1855, that there is one circumstance in which they all coincide—the benevolent and beneficent care of those who cannot care for themselves—and this central idea, which we trace in all, is the Idea of the Storiation.

So also, if observing representations or names of:—Moses, Joshua, David: then we would guess Hebrew worthies, for a School. If of:—David, Charles Martel, Alfred: then Patriot Kings for a Palace. If of:—Moses, Lykurgos, Justinian, Napoleone: then Legislators, for a Senate house. If of: Napoleone, Hannibal, Charlemagne: then Generals who have crossed the Alps, for a Military School. If of:—Pliny, Cuvier, Linnæus, Owen, then Naturalists, for a Natural-history Museum.

This connecting of different Events or Persons by the central Idea, as if separate Pearls on the same silk, or separate Stones in the same setting, is an expedient which has often been used in our sister Art of Literature; and it is one of the great charms of Storiation.

### § 23.—SOME SOURCES.

In LITERATURE the Sources for Ideas are many and copious.

The Bible is full of such, which are familiar and dear to all; and from its riches may be picked out such as are appropriate to all sorts and conditions of men. For the Palace—David and Hezekiah; for the Judgment hall—Samuel and Gideon: for Civic life—there are no events or persons, but the Proverbs have been a rich store for Epigraphy: and for the Peasant—Jacob and Ruth—among others.

Other Collections which appear, almost, to belong to Humanity are Homer, Dante, and the beautiful Sanscrit legends which have been presented to Western ears by Sir Edwin Arnold.

Our own literature lies still nearer; and Chaucer, Spenser, Shakspere, Swift, and Burns, are ever fresh.

In our own time the Poets have shown sympathy with our Arts; and hence the works of such men as Browning, Rossetti, Tennyson, Longfellow, and Morris, are full of suggestion which have been used with avidity.

CONTEMPORANEOUS EVENTS will also furnish circumstances and incidents which might be utilized to give a point of interest to our work.

Work which sets down Facts, will increase in interest as time goes on, while that which merely gives us the old Imaginations of Fames, Victories, and Cupids, will soon cease to have any.

And: further it may be averred that there are Saints and Heroes around, probably as worthy as some that have been officially stamped, who (typically represented) would make our work more worthy of our age.

### § 24.—CAUTIONS.

ERRORS may arise in Place, Kind, and Quantity.

The PLACE, when Storiation is applied externally, may be on all buildings and on most other objects; but, when applied internally, it is more appreciated in public than in home life.

On Functional features it should be avoided. Thus the Niches of a building (which are decorative) might contain statues of Statesmen, etc., but for the Telamones or supporting figures of a portico (which are functional) there should be no portraiture. A portico supported by two William Pitts, or by Pitt at one side and Fox at the other, would be absurd.

On Borders, as a general rule, it should be avoided; and should be reserved for Panels and Friezes.

The KIND should not be too grave for its place. People do not like high tension in their homes; and, when any storiation is introduced, it should be of a pleasing rather than harrowing character.

The QUANTITY should not overpower the æsthetic nature of the decoration. It should be used rather as a "flavoring" than as the staple portion of the work, unless absolutely necessary by the function of the object.

### § 25.—OPPORTUNITIES.

Storiation might be used much more than at present, in England. It is not the whole nor the chief gospel of Decorative Art. It will not bring the Millennium; but it will add Meaning to Beauty, as Beauty was added to Truth; and, there are Mosaic workers and Relief sculptors, in numbers, who could execute all that is required to make our Streets beautiful with color and delightful with Stories that should again be as books to poor men.

And Indoors, in the house and the school, there are spaces which it is the aim of some well-known Societies to fill; and among the latest of these are the efforts by Messrs. Selwyn Image, Heywood Sumner, and others.

The writer thus pleads for more Storiation, for more of these "Histories and Sermons which we can read without the trouble of turning over the leaves," so that the surroundings, and with them the lives, of our land may be made more beautiful.

## THE NEW HOSPITAL FOR CHILDREN, IN LEIPZIG.

IN the eastern part of the city of Leipzig, not far from the medical quarter, stand the fine buildings of the new Children's Hospital. A much-needed institution, founded by the city and the benevolence of the citizens, it is an eloquent monument of the spirit of charity that reigns in Leipzig. At the same time it forms an architectural ornament for the East End, and is worthy of being ranked with the Johannes Hospital and the new Book Exchange, the most imposing buildings in this part of the city.

It is made of colored brick, and consists of six separate buildings, which, together, cover an area of 96,875 sq. ft., and are surrounded by a little park; these are, the main building, three little buildings for diphtheria, scarlet fever, and measles, the polyclinic building, the building for offices, etc., and finally the dead house.

About the middle of the west side of the rectangle, on Platzmannstrasse, is the reception building, also serving for the polyclinic. It is the only building that has an entrance on the street, the others being separated from the street by the garden, so as to lessen the effect of the traffic and noise of the public thoroughfare. This main entrance leads into the hall, from which we pass to the clinic room and the managers' rooms.

To the right of this is the main building that rises above the others. Its facade is broken by colored cross bands and projecting verandas. Here are the large wards and also the single rooms for little patients who are not suffering from contagious diseases; those who are ill with diseases of this kind are accommodated

TAKING A WALK.

BABY WITH BROKEN LEG.

SISTER WATCHING AT NIGHT.

DINNER.

VISIT OF PHYSICIANS.

in structures on the farther side of the square. The difference in the sizes of the buildings indicates the relative proportion in the number of cases of the several diseases. The diphtheria house is much larger than that of scarlet fever, and the one for measles is only planned as yet. In the corner, at the left of the reception building, lies the smallest structure, the chapel-like front of which indicates the serious purpose to which it is dedicated.

Opposite the main building, on Schwarzenbergstrasse, is the building for offices, etc. The plans for this new structure were drawn by the Leipzig architect, Arwed Rossbach, under the supervision of the medical directors (especially of Prof. Heubner). The artist took the idea remarkably well, giving the whole such a warm, inviting character that a connoisseur would guess at a glance the object for which the building was designed. Its entire arrangement is excellent, and the completed work betokens the kind-hearted dispenser. For nearly a year the establishment has been in running order, and many a sick child has found care and health in the light and airy rooms. The wards of the medical, as well as of the surgical department, are full, showing the great need of a hospital for children.

Let us look through the rooms with the artist who has made the accompanying drawings from nature. Everything seems so pleasant that misery and sick-

WAITING AND APPLICATION ROOM.

POLYCLINIC.

ness lose something of their dreadful aspect even to the eyes of the laity. The children lie in their comfortable beds with happy faces. When the bathing and feeding of the early morning are over, the physicians begin their visits for examination and treatment. This is a time much dreaded by new comers, especially where, as in the case of the little one shown in our engraving, the whole head has to be bandaged and the sore upper lip must be covered with a moustache of cotton, for the cure of an eruption. But soon the feeling of comfort quiets the little patient and it starts on its first walk, taking hold of the nurse's hand. And how contentedly the other little one smiles with his little broken leg fastened up in the air so that he does not feel the least pain and the cure progresses rapidly.

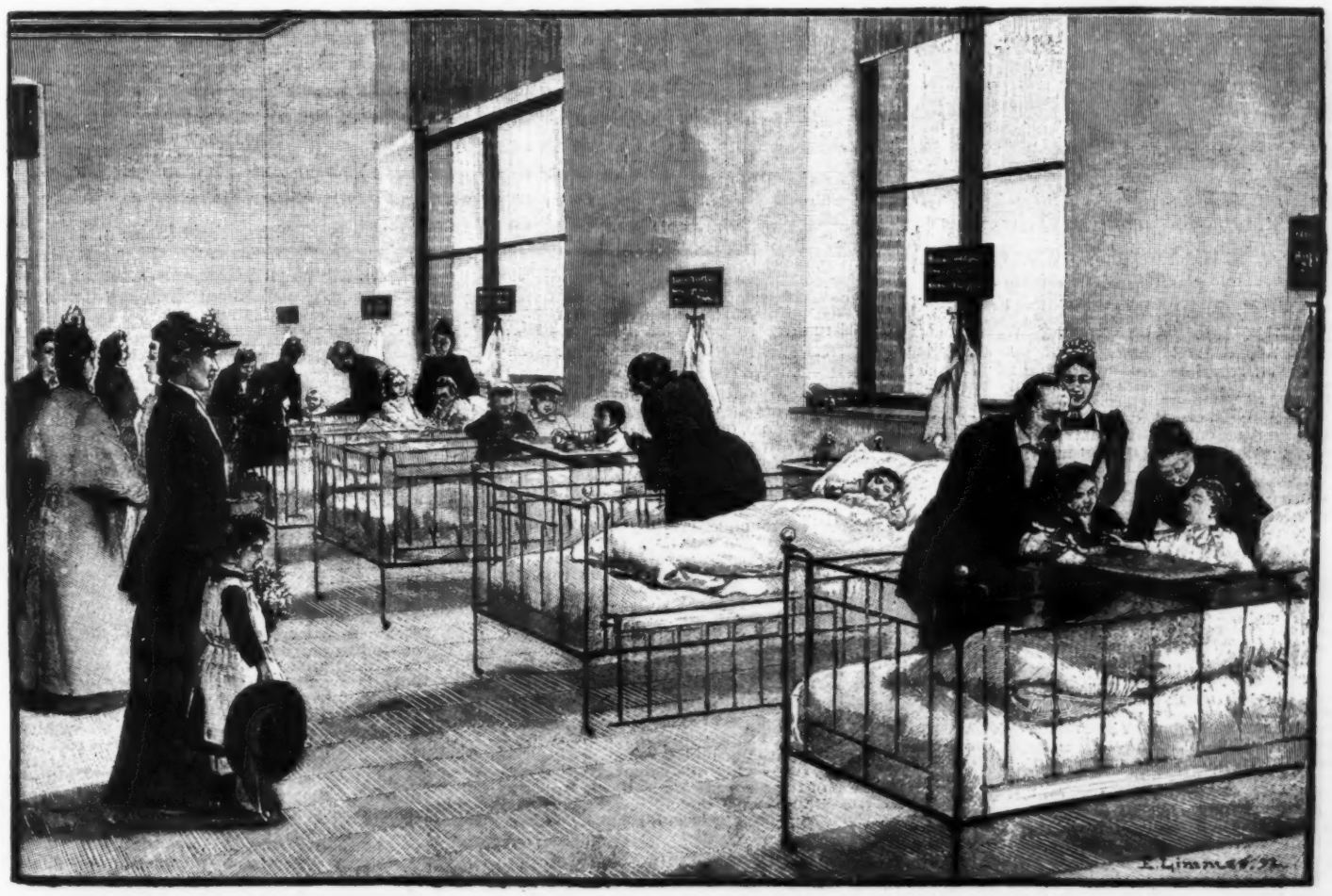
Children who have had rickets and have improved so as to be able to move themselves, to get up and to take a few steps, are placed from time to time in a little inclosure on a level with the floor, surrounded by a wooden railing and provided with bedding. There is often a great deal of life in one of these miniature rooms.

For the convalescent older children who can leave their beds, there is a spacious day room between each two wards, where they can play and eat their meals.

Wednesday and Sunday afternoons are happy times, for then the parents come to visit their sick darlings, bringing perhaps a new toy to brighten the hours of suffering. It is against the rules to take food.

The hours for the polyclinic, from 2 to 4 every afternoon, are very busy ones. There are often 100 people waiting in the reception building for their turn to be admitted to the examination rooms that open from the large waiting room, to ask help and advice for children of all ages. Four physicians are busy here for several hours every day.

The medical treatment in the polyclinic is entirely gratuitous, but in the hospital most of the children



A WARD ON SUNDAY AFTERNOON.

have to pay a small amount for treatment, for unfortunately there are, as yet, only three entirely free beds.

## THE CORRECT PRONUNCIATION OF MEDICAL TERMS.*

By WM. DULANEY THOMAS, M.D., and EUGENE L. CRUTCHFIELD, M.D., F.S.Sc. Lond.

THE amount of false pronunciation noticeable in the speech of medical men is a matter of which very few are aware until their attention is called to it. We refer here not to errors made in the use of their mother tongue, though the number of these is also truly appalling, for it is a well-known fact that physicians as a class are more deficient in general education than the members of any other profession. We desire, however, to call attention to some of the mistakes so common in the use of technical terms. This is a subject little dwelt upon. In fact, we do not remember having ever heard it alluded to from the lecturer's desk, nor have we ever seen an article in any medical journal in which this topic was discussed.

Of the importance of the question there can be no doubt. It is as necessary for a professional man to pronounce correctly the technical terms incident to his calling as it is for an educated person to observe the rules of orthoepy when speaking his native language.

We propose to mention, first, a group of words having a common ending generally mispronounced, and then to give a number of terms not admitting of classification, the pronunciation of which is also frequently at fault.

Groups.—Words ending in *alis*, as digitalis, frontalis, pyramidalis, etc. In these the sound of *a* is long, as in the word day; not short, as in alley.

Words ending in *ata* and *atus*, as oblongata, innominata, meatus, hiatus, seratus, etc. Here also the sound of *a* is long (as *a* in gay).

Words ending in *cele* (Greek *ke-le*, a tumor), as hy-

CURED AND GOING AWAY.

drocele, bronchocele, mucocele. In these the termination should be divided into two syllables, so that the pronunciation of these words is, hy-dro-*ce*-le, bron-cho-*ce*-le, mu-co-*ce*-le. We are aware of the fact that Webster does not give this pronunciation, but it is that advocated by Dunglison, and it is certainly borne out by the etymology of these terms.

Words ending in *ery*, as dysentery, mesentery, psorentery. In these only the pre-antepenultimate syllable should be accented. Therefore the pronunciation of these words is *dys*-entery, *mes*-entery, *pso*-rentery (not dysen-*ter*-y, mesen-*ter*-y, psoren-*ter*-y, as we so often hear).

Words ending in *itis*. In these the sound of the first *i* of the termination is long (like *i* in kite). Consequently we should say bron-*chi*-tis, i-*ri*-tis, gingi-*vi*-tis; and not bron-*chee*-tis, i-*ree*-tis and gingi-*vee*-tis.

Words not admitting of classification (the accented syllable is in *italics*): ab-*do*-men (not *ab*-domen), *o* is long as in *note;* accele-*ra*-tor u-*ri*-næ, ac-u-*punct*-ure (Dunglison erroneously says "ay-cu-*punct*-ure"), ad-*ju*-vant (Webster) or *ad*-ju-vant (Dunglison), al-*bi*-no, albu-*gin*-æ, al-*lop*-athy, an-*æm*-ic (although Webster, ignoring the derivation of the word, makes it an-*em*-ic), an-*ti*-cus, *a*-nus (not *an*-us), *a*-pis mel-*lif*-ica, appa-*ra*-tus, *as*-arum, asthe-*ni*-a (not as-*thee*-nia), *bro*-mide (pronounced *bro*-mid, *o* is long); *bro*-midum (pronounced *bro*-mid-um), ca-*da*-ver (*da* as in day), *can*-tharis, car-*bo*-nas, *ca*-se-ine or *ca*-se-in (not *cas*-e-ine nor *cas*-e-in), cer-*vi*-cis (not *cer*-vicis), *cer*-ebrum and *cer*-ebral (not ce-*re*-brum and ce-*re*-bral), *cer*-ebro *spi*-nal, ci-*ca*-trix (plural cic-a-*tri*-ces), cemi-*cif*-uga, *cat*-echu (pronounced *kat*-eshoo), *ci*-tras or *cit*-ras; *ci*-trate or *cit*-rate, *ci*-tric or *cit*-ric, *ci*-trus or *cit*-rus, chim-*aph*-ila (pronounced kim-*aph*-ila), co-*ro*-na, *chol*-ic (not *cho*-lic), *chin*-inum (pronounced *kin*-inum), *col*-chicum (pronounced *kol*-ki-kum), conjunc-*ti*-va, co-*ni*-um, cru-*re*-us, de-*tri*-tus, duo-*de*-num, *ec*-zema (not ec-ze-ma), empy-*e*-ma, *en*-ema (plural en-*em*-ata), ep-*u*-lis, epizo-*ot*-ic (not epi-*zoot*-ic), eu-*sta*-chian (pronounced yu-*sta*-kean), *ex*-crement, *ex*-cretory or ex-*cre*-tory, *far*-adic (not fa-*ra*-dic), fa-*ri*-na, *feb*-rifuge (*feb* as in *February*), febrile (pronounced either *fee*-bril or *feb*-ril), fo-*ra*-men (plural fo-*ra*-mina); *ra* like *ray*; *gal*-banum, *gle*-noid, *glo*-no-in, glu-*tae*-us (not *glu*-teus), gly-*coch*-olic, gra-*phi*-tes, guaiacum (pronounced *gwa*-ya-cum), hel-*leb*-orus, hydran-*ge*-a or hy-*dran*-gea, hy-*per*-trophy, hyper-*pla*-sia, hyo-*scy*-amus and hyo-*scy*-amine, il-*i*-acus and il-i-aca (*i* long), i-o-didum (not io-*did*-um), i-*od*-oform (Webster) or *i*-odo-form (Dunglison), ja-*la*-pa, *jug*-ular (Webster, ignoring its derivation from Latin *jug*-u-lum, says *ju*-gular), *kre*-atinine (Dunglison) or kre-*at*-inine (Webster), le-*va*-tor, lichen pronounced *li*-ken or *litch*-en (as a medical word Smart gives *li*-ken, as a botanical term *litch*-en; Dunglison pronounces it *li*-ken); liquor (pronounced *lik*-ur), *mas*-seter (Webster) or mas-*se*-ter (Dunglison), mal-*le*-olus, matico (pronounced ma-*tee*-co), media-*sti*-num, mem-*bra*-na, met-*as*-tasis and meta-*stat*-ic, *mol*-ecule, *na*-res (genitive, *na*-rium), *na*-sus, neu-*rog*-lia, o-*rig*-anum, os (bone), short *o*, as in os innomi-*na*-tum, os (mouth), long *o*, as in os *u*-teri, *par*-esis, pharmaco-*pœ*-ia (pronounced pharmaco-*pee*-ya), phthisis (pronounced *thigh*-sis), phthisical (pronounced *tiz*-ical), phar-*yn*-geal or pharyn-*ge*-al, *plat*-ina or plat-*ti*(tee)na, so pla-*ti*-num or pla-*ti*-num, *pleth*-ora (Webster) Dunglison gives ple-*tho*-ra, in accordance with Walker's rule that words imported *whole* from Greek or Latin should keep their original accents; ple-*tho*-ric or *pleth*-oric, *pre*-puce, pos-*ti*-cus, pru-*ri*-tus, *qui-nia* (Dunglison), quin-i-a (*kwin*-ia), quin-ina (*kwin*-ina) *qui*-nine or qui-*nine* (Webster); ranula (pronounced *ray*-nula), re-*si*-na, ro-*se*-ola, ru-*be*-ola, sacral and sacrum (pronounced *say*-cral, and *say*-crum), sa-*git*-tal (Dunglison) or *sag*-ittal (Webster) *g* is like *j*; sa-*ti*-va, schindylesis (Greek word pronounced skin-*dye*-lesis), se-*ro*-tina (*o* long), *squa*-mous (pronounced *squay*-mus), *syr*-inge, *syr*-up (*y* pronounced like *i* in sit), sy-*ru*-pus, tabes (pronounced *tay*-beez), ta-*ran*-tula or ta-*ren*-tula, tau-*roch*-olic, tin-*ni*-tus (*i* of *ni* long), trachea (preferable pronunciation tray-*chee*-a; allowable, *tray*-che-a; common but wrong, *trak*-ee-a), troche (pronounced *tro*-kee, *o* long), *tym*-panum, umbi-*li*-cus (*i* in *li* long), vaginal (pronounced *vaj*-inal or va-*jy*-nal), va-*ri*-ola (*i* long), wormi-*a*-na, *xiph*-oid, yeast (*yeest*), yolk (*yolk*, *o* long, or *yoke*), *zin*-giber (genitive, zin-*gib*-eris), *g* like *j*; zy-*go*-ma (*y* and *o* long, Dunglison and Webster; according to Walker's rule, it should be *zyg*-oma, *y* being short and accented, as in the original Greek).

It is not to be supposed that the above list embraces all the terms that could be cited in this connection. It is, however, sufficiently exhaustive to direct the attention of the reader to the subject, to show him its vastness, and to give him an insight into the amount of incorrect pronunciation common among medical men.

* From the *Maryland Medical Journal*.

THE water pump of to-day is but an improvement on a Grecian invention which first came into use during the reign of Ptolemies Philadelphos and Energetes, 283 to 221 B.C.

## THE MANUFACTURE OF LIQUORS AND PRESERVES.*

By J. DE BREVANS, Chief Chemist of the Municipal Laboratory of Paris.

AT the same time the temperature of the liquid is determined by means of a thermometer, so that the correction for temperature may be made, the alcoholometers being graduated at a temperature of 15° C., and a correction must be made for all other temperatures. To facilitate or rather eliminate this correction Gay-Lussac's tables are used. The tables are constructed as follows: On the first horizontal line is given the apparent strength, that is to say, the degree marked by the alcoholometer when it is plunged in the liquid at the temperature of the surroundings. In the first vertical column are inscribed all temperatures between 0° and 30° (Centigrade). The real strength of the liquid will be found at the point of intersection of the vertical column, which is commenced by the apparent strength, and the horizontal line, which corresponds to the actual temperature. The volume, which at 15° (C.) would occupy 1,000 liters measured at the temperature at which the apparent strength has been taken, is

TABLE I.

| Temperatures. | INDICATIONS OF THE ALCOHOLOMETER. APPARENT STRENGTH. | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1° | 2° | 3° | 4° | 5° | 6° | 7° | 8° | 9° | 10° | 11° | 12° | 13° | 14° | 15° | 16° | 17° | 18° | 19° | 20° |
| 0° | 1.3 1000 | 2.4 | 3.4 | 4.4 | 5.4 | 6.5 1001 | 7.5 | 8.6 | 9.7 | 10.9 | 12.2 | 13.4 1002 | 14.7 | 16.1 | 17.5 | 18.9 1003 | 20.3 | 21.6 1004 | 22.9 | 24.2 |
| 1 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 13.4 1002 | 14.7 | 16 | 17.3 | 18.7 1003 | 20 | 21.3 | 22.6 1004 | 23.9 |
| 2 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 13.4 1002 | 14.7 | 16 | 17.2 | 18.5 1003 | 19.8 | 21.1 | 22.3 1004 | 23.6 |
| 3 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 13.3 1001 | 14.6 1002 | 15 9 | 17.1 | 18.3 1003 | 19.6 1003 | 20.8 | 22 | 23.3 1004 |
| 4 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 13.3 1001 | 14.5 1002 | 15.8 | 16 9 | 18.1 | 19.4 | 20.6 1003 | 21.8 | 23 |
| 5 | 1.4 1001 | 2.5 | 3.5 | 4.5 | 5.5 | 6.6 | 7.7 | 8.7 | 9.8 | 10.9 | 12.1 | 13.2 | 14.4 | 15.7 1002 | 16.8 | 18 | 19.2 | 20.4 1003 | 21.5 | 22.7 |
| 6 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 13.1 1001 | 14.3 | 15.6 1002 | 16.7 | 17.8 | 19 | 20.2 1003 | 21.3 | 22.4 |
| 7 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 13 1001 | 14.2 | 15.4 | 16.6 1002 | 17.7 | 18.8 | 20 | 21 | 22.1 |
| 8 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 13 1001 | 14.1 | 15.3 | 16.4 | 17.5 | 18 6 1002 | 19.7 | 20.7 | 21.8 |
| 9 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 12.9 1001 | 14 | 15.1 | 16.2 | 17.3 | 18.4 | 19.5 | 20.5 1002 | 21.6 |
| 10 | 1.4 1000 | 2.4 | 3.4 1001 | 4.5 | 5.5 | 6.5 | 7.5 | 8.5 | 9.5 | 10.6 | 11.7 | 12.7 | 13.8 | 14.9 | 16 | 17 | 18.1 | 19.2 | 20.2 | 21.3 |
| 11 | 1.3 1000 | 2.4 | 3.4 | 4.4 | 5.4 | 6.4 | 7.4 | 8.4 | 9.4 | 10.5 | 11.6 | 12.6 | 13.6 | 14.7 | 15.8 | 16.8 | 17.9 | 19 | 20 | 21 |
| 12 | 1.2 1000 | 2.3 | 3.3 | 4.3 1001 | 5.3 | 6.3 | 7.3 | 8.3 | 9.3 | 10.4 | 11.5 | 12 5 1001 | 13.5 | 14.6 | 15.6 | 16.6 | 17.6 | 18.7 | 19.7 | 20.7 |
| 13 | 1.2 1000 | 2.2 | 3.2 | 4.2 | 5.2 | 6.2 | 7.2 | 8.2 | 9.2 | 10.3 | 11.4 | 12.4 | 13.4 | 14.4 | 15.4 | 16.4 | 17.4 | 18.5 | 19.5 | 20.5 |
| 14 | 1.1 1000 | 2.1 | 3.1 | 4.1 | 5.1 | 6.1 | 7.1 | 8.1 | 9.1 | 10.2 | 11.2 | 12.2 | 13.2 | 14.2 | 15.2 | 16.2 | 17.2 | 18.2 | 19.2 | 20.2 |
| 15 | 1 1000 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 16 | 0.9 1000 | 1.9 | 2.9 | 3.9 | 4.9 | 5.9 | 6.9 | 7.9 | 8.9 | 9.9 | 10.9 | 11.9 | 12 9 | 13.9 | 14.9 | 15.9 | 16.9 | 17.8 | 18.7 | 19.7 |
| 17 | 0.8 1000 | 1.8 | 2.8 | 3.8 | 4.8 | 5.8 | 6.8 | 7.8 | 8.8 | 9.8 | 10.8 | 11.7 | 12.7 | 13.7 | 14.7 | 15.6 | 16.6 | 17.5 | 18.4 999 | 19.4 |
| 18 | 0.7 1000 | 1.7 | 2.7 | 3.7 | 4.7 | 5.7 | 6.7 | 7.7 | 8.7 | 9.7 | 10.7 | 11.6 | 12 5 999 | 13.5 | 14.5 | 15.4 | 16.3 | 17.3 | 18.2 | 19.1 |
| 19 | 0.6 999 | 1 6 | 2.6 | 3.6 | 4.5 | 5.5 | 6.5 | 7.5 | 8.5 | 9.5 | 10 5 | 11.4 | 12.4 | 13.3 | 14.3 | 15.2 | 16.1 | 17 | 17.9 | 18.8 |
| 20 | 0.5 999 | 1 5 | 2.4 | 3.4 | 4.4 | 5.4 | 6.4 | 7.3 | 8.3 | 9.3 | 10 3 | 11.2 | 12.2 | 13.1 | 14 | 14.9 | 15.8 | 16.7 | 17.6 | 18.5 |
| 21 | 0.4 999 | 1.4 | 2.3 | 3.3 | 4.3 | 5.2 | 6.2 | 7.1 | 8.1 | 9.1 | 10.1 | 11 | 11.9 | 12.8 | 13.7 | 14.6 | 15.5 998 | 16.4 | 17.3 | 18.2 |
| 22 | 0.3 999 | 1.3 | 2.2 | 3.2 | 4.1 | 5.1 | 6.1 | 7 | 7.9 | 8.9 | 9.9 | 10.8 | 11.7 | 12.6 998 | 13.5 | 14.4 | 15.3 | 16.2 | 17 | 17.9 |
| 23 | 0.1 999 | 1.1 | 2.1 | 3.1 | 4 | 4.9 | 5.9 | 6.8 998 | 7.8 | 8.7 | 9.7 | 10.6 | 11.5 | 12.4 | 13.3 | 14.1 | 15 | 15.9 | 16.7 | 17.6 |
| 24 | ..... | 1 998 | 1.9 | 2.9 | 3.8 | 4.8 | 5.8 | 6.7 | 7.6 | 8.5 | 9.5 | 10.4 | 11.3 | 12.2 | 13.1 | 13.9 | 14.8 | 15.7 | 16.5 997 | 17.4 |
| 25 | ..... | 0.8 998 | 1.7 | 2.7 | 3.6 | 4.6 | 5.5 | 6.5 | 7.4 | 8.3 | 9.3 | 10.2 | 11.1 | 12 | 12.8 | 13.6 | 14.5 997 | 15.4 | 16.2 | 17.1 |
| 26 | ..... | 0 7 998 | 1.6 | 2.6 | 3.5 | 4.4 | 5.4 | 6.3 | 7.2 | 8.1 | 9 | 9.9 997 | 10.8 | 11.7 | 12.6 | 13.4 | 14.2 | 15.1 | 15.9 | 16.8 |
| 27 | ..... | 0.5 998 | 1.5 | 2.4 | 3.3 | 4.3 | 5.2 | 6.1 | 7 | 7.9 | 8.8 997 | 9.7 | 10.6 | 11.5 | 12.3 | 13.1 | 14 | 14.8 | 15.6 | 16.5 |
| 28 | ..... | 0 3 997 | 1.3 | 2.2 | 3.1 | 4.1 | 5 | 5.9 | 6.8 | 7.7 | 8.6 | 9.5 | 10.3 | 11.2 | 12 | 12.8 996 | 13.7 | 14.5 | 15.3 | 16.1 |
| 29 | ..... | 0.1 997 | 1.1 | 2 | 2.9 | 3.9 | 4.8 | 5.7 | 6.6 | 7.5 | 8.4 | 9.2 | 10.1 | 11 | 11.8 996 | 12.6 | 13.4 | 14.2 | 15 | 15.8 |
| 30 | ..... | 0.0 997 | 0.9 | 1.9 | 2.8 | 3.7 | 4.6 | 5.5 | 6.4 | 7.3 | 8.1 | 9 996 | 9.8 | 10.7 | 11.5 | 12.3 | 13.1 | 13.9 | 14.7 | 15.5 |

given by the number inscribed under the figures representing the actual strength, or, if there is none, by the first number encountered at the left on the same line.

(*To be continued.*)

## COCKLE SEED.

A COMMON impurity in many seeds which are used as food for live stock is the seed of corn cockle (*Agrostemma githargo*). Notably is this the case on the Continent, and especially in Hungary, where the refuse from the machines used in cleaning grain consists chiefly of cockle seed, and is largely used in feeding swine. It appears, as a rule, to have no ill effect upon these animals. Upon other animals, however, it sometimes has serious and even fatal effects, especially upon calves and dogs. According to Kobert (*Landw. Centralblt. Provinz Posen*, 19) it would appear that the seeds contain a glucoside—saponin $C_{72}H_{14}O_{18}$—which acts as a poison either when eaten in the form of cockle seed or when introduced into the blood. Various animals are affected in different degrees, but dogs, cats and birds soon die when fed upon the seed. The poison decomposes the blood, dissolving the red corpuscles, and also destroys the sensitive albuminoid portion of the nerve elements. Heating to 50° C. decomposes the saponin and renders the seed harmless. Since this glucoside is found to lie only just below the surface of the seed, Kobert suggests that the seed should be coarsely ground and the outer husk separated; to cook the meal would be a still safer precaution. A good deal of cockle seed comes into the port of Hull, chiefly, it is presumed, among grain which has not been screened. From such seeds as linseed it is removed by screening before pressing, but it is too often found in the cake which results after the oil is expressed from the linseed. A considerable quantity

* Continued from page 14332, SUPPLEMENT, No. 897.

TABLE II.

INDICATIONS OF THE ALCOHOLOMETER.

APPARENT STRENGTH.

| Temperatures | 21° | 22° | 23° | 24° | 25° | 26° | 27° | 28° | 29° | 30° | 31° | 32° | 33° | 34° | 35° | 36° | 37° | 38° | 39° | 40° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0° | 25.6 | 27 | 28.4 | 29.7 | 30.9 | 32.1 | 33.2 | 34.3 | 35.3 | 36.3 | 37.3 | 38.3 | 39.2 | 40.2 | 41.1 | 42.1 | 43.1 | 44 | 45 | 45.9 |
| | 1005 | | 1006 | | 1007 | | | 1008 | | | 1009 | | | | | 1010 | | | | 1011 |
| 1 | 25.3 | 26.7 | 28 | 29.2 | 30.4 | 31.6 | 32.7 | 33.8 | 34.8 | 35.8 | 36.8 | 37.8 | 38.8 | 39.8 | 40.8 | 41.8 | 42.7 | 43.7 | 44.6 | 45.5 |
| | 1005 | | | 1006 | | | 1007 | | | 1008 | | | | | 1009 | | | | 1010 | |
| 2 | 24.9 | 26.3 | 27.5 | 28.8 | 30 | 31.2 | 32.3 | 33.3 | 34.4 | 35.4 | 36.4 | 37.4 | 38.4 | 39.4 | 40.4 | 41.4 | 42.3 | 43.3 | 44.2 | 45.1 |
| | 1004 | 1005 | | | 1006 | | | | 1007 | | | | 1008 | | | | | 1009 | | |
| 3 | 24.6 | 25.9 | 27.1 | 28.4 | 29.6 | 30.8 | 31.9 | 32.9 | 33.9 | 34.9 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 42.9 | 43.9 | 44.8 |
| | 1001 | 1005 | | | | 1006 | | | 1007 | | | | | | | 1008 | | | | |
| 4 | 24.3 | 25.6 | 26.8 | 28 | 29.2 | 30.4 | 31.4 | 32.5 | 33.5 | 34.5 | 35.5 | 36.5 | 37.5 | 38.5 | 39.5 | 40.5 | 41.5 | 42.5 | 43.5 | 44.4 |
| | 1001 | | 1005 | | | | | | 1006 | | | | | 1007 | | | | | | 1008 |
| 5 | 24 | 25.2 | 26.4 | 27.6 | 28.8 | 30 | 31 | 32.1 | 33.1 | 34.1 | 35.1 | 36.1 | 37.1 | 38.1 | 39.1 | 40.1 | 41.1 | 42.1 | 43.1 | 44 |
| | 1003 | | 1004 | | | | 1005 | | | | | 1006 | | | | | 1007 | | | |
| 6 | 23.6 | 24.9 | 26 | 27.2 | 28.4 | 29.6 | 30.6 | 31.6 | 32.6 | 33.6 | 34.7 | 35.7 | 36.7 | 37.7 | 38.7 | 39.7 | 40.7 | 41.6 | 42.6 | 43.6 |
| | 1003 | | 1004 | | | | 1005 | | | | | | | | | 1006 | | | | |
| 7 | 23.3 | 24.6 | 25.7 | 26.9 | 28 | 29.2 | 30.2 | 31.2 | 32.2 | 33.2 | 34.2 | 35.2 | 36.2 | 37.2 | 38.2 | 39.2 | 40.2 | 41.2 | 42.2 | 43.2 |
| | 1002 | 1003 | | | | | 1004 | | | | | | | 1005 | | | | | | |
| 8 | 23 | 24.2 | 25.3 | 26.5 | 27.6 | 28.8 | 29.8 | 30.8 | 31.8 | 32.8 | 33.8 | 34.8 | 35.8 | 36.8 | 37.8 | 38.8 | 39.8 | 40.8 | 41.8 | 42.8 |
| | 1002 | | 1003 | | | | | | | | 1004 | | | | | | | | | 1005 |
| 9 | 22.7 | 23.9 | 25 | 26.1 | 27.2 | 28.4 | 29.4 | 30.4 | 31.4 | 32.4 | 33.4 | 34.4 | 35.4 | 36.4 | 37.4 | 38.4 | 39.4 | 40.4 | 41.4 | 42.4 |
| | 1002 | | | | | 1003 | | | | | | | | | 1004 | | | | | |
| 10 | 22.4 | 23.5 | 24.6 | 25.7 | 26.8 | 27.9 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 |
| | 1001 | 1002 | | | | | | | | | | | 1003 | | | | | | | |
| 11 | 22.1 | 23.2 | 24.3 | 25.4 | 26.5 | 27.6 | 28.6 | 29.6 | 30.6 | 31.6 | 32.6 | 33.6 | 34.6 | 35.6 | 36.6 | 37.6 | 38.6 | 39.6 | 40.6 | 41.6 |
| | 1001 | | | | 1002 | | | | | | | | | | | | | | 1003 | |
| 12 | 21.8 | 22.9 | 24 | 25.1 | 26.1 | 27.2 | 28.2 | 29.2 | 30.2 | 31.2 | 32.2 | 33.2 | 34.2 | 35.2 | 36.2 | 37.2 | 38.2 | 39.2 | 40.2 | 41.2 |
| | 1001 | | | | | | | | | | | | 1002 | | | | | | | |
| 13 | 21.5 | 22.6 | 23.6 | 24.7 | 25.7 | 26.8 | 27.8 | 28.8 | 29.8 | 30.8 | 31.8 | 32.8 | 33.8 | 34.8 | 35.8 | 36.8 | 37.8 | 38.8 | 39.8 | 40.8 |
| | 1001 | | | | | | | | | | | | | | | | | | | |
| 14 | 21.2 | 22.3 | 23.3 | 24.3 | 25.3 | 26.4 | 27.4 | 28.4 | 29.4 | 30.4 | 31.4 | 32.4 | 33.4 | 34.4 | 35.4 | 36.4 | 37.4 | 38.4 | 39.4 | 40.4 |
| | 1000 | | | | | | | | | | | | 1001 | | | | | | | |
| 15 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| | 1000 | | | | | | | | | | | | | | | | | | | |
| 16 | 20.7 | 21.7 | 22.7 | 23.7 | 24.7 | 25.7 | 26.6 | 27.6 | 28.6 | 29.6 | 30.6 | 31.6 | 32.5 | 33.5 | 34.5 | 35.5 | 36.5 | 37.5 | 38.5 | 39.5 |
| | 1000 | | | | | | | | | | | | 999 | | | | | | | |
| 17 | 20.4 | 21.4 | 22.4 | 23.4 | 24.4 | 25.4 | 26.3 | 27.3 | 28.2 | 29.2 | 30.2 | 31.2 | 32.1 | 33.1 | 34.1 | 35.1 | 36.1 | 37.1 | 38.1 | 39.1 |
| | 999 | | | | | | | | | | | | | | | | | | | |
| 18 | 20.1 | 21.1 | 22 | 23 | 24 | 25 | 25.9 | 26.9 | 27.8 | 28.8 | 29.8 | 30.8 | 31.7 | 32.7 | 33.7 | 34.7 | 35.7 | 36.7 | 37.7 | 38.7 |
| | 999 | | | | | | | | | | | | 998 | | | | | | | |
| 19 | 19.8 | 20.8 | 21.7 | 22.7 | 23.6 | 24.6 | 25.5 | 26.5 | 27.4 | 28.4 | 29.4 | 30.4 | 31.3 | 32.3 | 33.3 | 34.3 | 35.3 | 36.3 | 37.3 | 38.3 |
| | 998 | | | | 999 | | | | | | | | | | | | | | 997 | |
| 20 | 19.5 | 20.5 | 21.4 | 22.4 | 23.3 | 24.3 | 25.2 | 26.1 | 27.1 | 28 | 29 | 30 | 30.9 | 31.9 | 32.9 | 33.9 | 34.9 | 35.9 | 36.9 | 37.9 |
| | 998 | 999 | | | | | | | | | | | 997 | | | | | | | |
| 21 | 19.1 | 20.1 | 21.1 | 22.1 | 23 | 23.9 | 24.8 | 25.7 | 26.7 | 27.6 | 28.6 | 29.6 | 30.5 | 31.5 | 32.5 | 33.5 | 34.5 | 35.5 | 36.5 | 37.5 |
| | 998 | | | | | | | | 997 | | | | 996 | | | | | 996 | | |
| 22 | 18.8 | 19.8 | 20.7 | 21.7 | 22.6 | 23.6 | 24.4 | 25.3 | 26.3 | 27.2 | 28.2 | 29.2 | 30.1 | 31.1 | 32.1 | 33.1 | 34.1 | 35.1 | 36.1 | 37.1 |
| | 998 | | | 997 | | | | | | | | | 996 | | | | | | | |
| 23 | 18.5 | 19.5 | 20.4 | 21.4 | 22.3 | 23.2 | 24.1 | 25 | 25.9 | 26.8 | 27.8 | 28.8 | 29.7 | 30.7 | 31.7 | 32.7 | 33.7 | 34.7 | 35.7 | 36.7 |
| | 998 | 997 | | | | | | | | | 996 | | | | | | | 995 | | |
| 24 | 18.3 | 19.2 | 20.1 | 21.1 | 21.9 | 22.8 | 23.7 | 24.6 | 25.5 | 26.4 | 27.4 | 28.4 | 29.3 | 30.3 | 31.3 | 32.3 | 33.3 | 34.3 | 35.3 | 36.3 |
| | 997 | | | | | | | 996 | | | | | 995 | | | | | | | 994 |
| 25 | 18 | 18.9 | 19.8 | 20.7 | 21.6 | 22.5 | 23.3 | 24.3 | 25.2 | 26.1 | 27 | 28 | 28.9 | 29.9 | 30.9 | 31.9 | 32.9 | 33.9 | 34.9 | 35.9 |
| | 997 | | | | 996 | | | | | | 995 | | | | | 994 | | | | |
| 26 | 17.7 | 18.6 | 19.5 | 20.4 | 21.3 | 22.2 | 23 | 23.9 | 24.8 | 25.7 | 26.6 | 27.6 | 28.5 | 29.5 | 30.5 | 31.5 | 32.5 | 33.5 | 34.5 | 35.5 |
| | 997 | 996 | | | | | | | 995 | | | | | 994 | | | | | 993 | |
| 27 | 17.4 | 18.3 | 19.2 | 20.1 | 20.9 | 21.8 | 22.7 | 23.6 | 24.4 | 25.3 | 26.2 | 27.2 | 28.1 | 29.1 | 30.1 | 31.1 | 32.1 | 33.1 | 34.1 | 35.1 |
| | 996 | | | | | | | | 995 | | | 994 | | | | 993 | | | | |
| 28 | 17 | 18 | 18.9 | 19.7 | 20.6 | 21.5 | 22.3 | 23.2 | 24 | 24.9 | 25.8 | 26.8 | 27.7 | 28.7 | 29.7 | 30.7 | 31.7 | 32.7 | 33.7 | 34.7 |
| | 996 | | | 995 | | | | | | 994 | | | | 993 | | | | | 992 | |
| 29 | 16.7 | 17.6 | 18.5 | 19.4 | 20.3 | 21.1 | 21.9 | 22.8 | 23.7 | 24.5 | 25.4 | 26.4 | 27.3 | 28.3 | 29.3 | 30.3 | 31.3 | 32.3 | 33 3 | 34.3 |
| | 996 | | 995 | | | | | 994 | | | | 993 | | | | 992 | | | | |
| 30 | 16.4 | 17.3 | 18.2 | 19.1 | 19.9 | 20.8 | 21.6 | 22.5 | 23.3 | 24.2 | 25.1 | 26 | 26 9 | 27.9 | 28.9 | 29.9 | 30.9 | 31.9 | 32.9 | 33.9 |
| | 995 | | | | | 994 | | | | | 993 | | | | 992 | | | 991 | | |

TABLE III.

INDICATIONS OF THE ALCOHOLOMETER.

APPARENT STRENGTH.

| Temperatures | 41° | 42° | 43° | 44° | 45° | 46° | 47° | 48° | 49° | 50° | 51° | 52° | 53° | 54° | 55° | 56° | 57° | 58° | 59° | 60° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0° | 46 9 | 47.9 | 48.8 | 49.8 | 50.7 | 51.7 | 52.6 | 53.5 | 54.5 | 55.4 | 56.4 | 57.3 | 58.3 | 59.2 | 60.2 | 61.2 | 62.1 | 63.1 | 64.1 | 65 |
| | 1011 | | | | | | 1012 | | | | | | | | | | | 1013 | | |
| 1 | 46.5 | 47.5 | 48.4 | 49.4 | 50.3 | 51.3 | 52.2 | 53.2 | 54.2 | 55.1 | 56 | 57 | 57.9 | 58 9 | 59.9 | 60.9 | 61.8 | 62.8 | 63.8 | 64.7 |
| | 1010 | | | | | 1011 | | | | | | | | | | | | 1012 | | |
| 2 | 46.1 | 47.1 | 48.1 | 49 | 49.9 | 50.9 | 51.8 | 52.8 | 53.8 | 54.7 | 55.7 | 56.6 | 57.6 | 58.5 | 59.5 | 60.5 | 61.5 | 62.4 | 63.4 | 64.4 |
| | 1009 | | | | 1010 | | | | | | | | | | | 1011 | | | | |
| 3 | 45.8 | 46.7 | 47 7 | 48.6 | 49.6 | 50 5 | 51.5 | 52.4 | 53.4 | 54.3 | 55.3 | 56.3 | 57 2 | 58.2 | 59.2 | 60.2 | 61 1 | 62.1 | 63.1 | 64.1 |
| | 1008 | 1009 | | | | | | | | | | | | 1010 | | | | | | |
| 4 | 45.4 | 46 4 | 47.4 | 48.3 | 49.2 | 50.2 | 51.1 | 52.1 | 53 | 54 | 55 | 56 | 56.9 | 57.9 | 58.9 | 59.8 | 60.8 | 61.7 | 62 7 | 63.7 |
| | 1008 | | | | | | | | | 1009 | | | | | | | | | | |
| 5 | 45 | 45.9 | 46.9 | 47.9 | 48.8 | 49.8 | 50.7 | 51.7 | 52.7 | 53.6 | 54.6 | 55.6 | 56.6 | 57.5 | 58.5 | 59.5 | 60.4 | 61.4 | 62.4 | 63 4 |
| | 1007 | | | | | | | 1008 | | | | | | 1007 | | | | | | |
| 6 | 44.6 | 45.5 | 46.5 | 47.5 | 48.4 | 49.4 | 50.4 | 51.4 | 52.4 | 53.3 | 54.3 | 55.2 | 56.2 | 57.1 | 58 1 | 59.1 | 60.1 | 61 | 62 | 63 |
| | 1006 | | | 1007 | | | | | | | | | | | | | | 1008 | | |
| 7 | 44 2 | 45 1 | 46.1 | 47.1 | 48.1 | 49.1 | 50.1 | 51 | 52 | 52.9 | 53.9 | 54.9 | 55.9 | 56.8 | 57.8 | 58.8 | 59.8 | 60.7 | 61.7 | 62.7 |
| | 1005 | 1006 | | | | | | | | | | | | | | | 1007 | | | |
| 8 | 43.8 | 44.8 | 45 8 | 46.8 | 47.7 | 48.7 | 49.7 | 50.6 | 51.6 | 52.6 | 53.6 | 54.6 | 55 5 | 56.5 | 57.5 | 58.5 | 59 5 | 60.4 | 61.4 | 62.4 |
| | 1005 | | | | | | | | | | | | | 1006 | | | | | | |
| 9 | 43 4 | 44.4 | 45 4 | 46 4 | 47.3 | 48.3 | 49.3 | 50.2 | 51.2 | 52.2 | 53.2 | 54.2 | 55.1 | 56.1 | 57.1 | 58.1 | 59 1 | 60 | 61 | 62 |
| | 1004 | | | | | | 1005 | | | | | | | | | | | | | |
| 10 | 43 | 44 | 45 | 46 | 46.9 | 47.9 | 48.9 | 49.9 | 50.9 | 51.8 | 52.8 | 53.8 | 54.8 | 55 8 | 56.8 | 57.8 | 58.8 | 59.7 | 60.7 | 61.7 |
| | 1003 | 1004 | | | | | | | | | | | | | | | | | | |
| 11 | 42.6 | 43.6 | 44.6 | 45.6 | 46 6 | 47.6 | 48.6 | 49.5 | 50.5 | 51.5 | 52.5 | 53.5 | 54.4 | 55.4 | 56.4 | 57.4 | 58.4 | 59.4 | 60.4 | 61.4 |
| | 1003 | | | | | | | | | | | | | | | | | | | |
| 12 | 42 2 | 43.2 | 44.2 | 45.2 | 46.2 | 47.2 | 48.2 | 49.2 | 50.2 | 51.1 | 52.1 | 53.1 | 54.1 | 55 | 56 | 57 | 58 | 59 | 60 | 61 |
| | 1002 | | | | | | | | | | | | | | | | | | | |
| 13 | 41.8 | 42.8 | 43.8 | 44.8 | 45.8 | 46.8 | 47.8 | 48.8 | 49.8 | 50.8 | 51.8 | 52.7 | 53.7 | 54.7 | 55.7 | 56.7 | 57.7 | 58.7 | 59.7 | 60.7 |
| | 1001 | | | 1002 | | | | | | | | | | | | | | | | |
| 14 | 41.4 | 42.4 | 43.4 | 44.4 | 45.4 | 46.4 | 47.4 | 48.4 | 49.4 | 50 4 | 51.4 | 52.3 | 53.3 | 54.3 | 55.3 | 56.3 | 57.3 | 58.3 | 59.3 | 60.3 |
| | 1001 | | | | | | | | | | | | | | | | | | | |
| 15 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| | 1001 | | | | | | | | | | | | | | | | | | | |
| 16 | 40.6 | 41.6 | 42.6 | 43.6 | 44.6 | 45.6 | 46.6 | 47.6 | 48.6 | 49.6 | 50.6 | 51.6 | 52.6 | 53.6 | 54 6 | 55.6 | 56.6 | 57.6 | 58.6 | 59.6 |
| | 999 | | | | | | | | | | | | | | | | | | | |
| 17 | 40.2 | 41.2 | 42.2 | 3.2 | 44.2 | 45.2 | 46.2 | 47.2 | 48.3 | 49.3 | 50.3 | 51.3 | 52.3 | 53.3 | 54.3 | 55.3 | 56.3 | 57.3 | 58.3 | 59.3 |
| | 999 | | | 998 | | | | | | | | | | | | | | | | |
| 18 | 39.8 | 40.8 | 41.8 | 42.8 | 43.8 | 44.9 | 45.9 | 46.9 | 47.9 | 48.9 | 49.9 | 50.9 | 51.9 | 52.9 | 53.9 | 54.9 | 55.9 | 56 9 | 57.9 | 58.9 |
| | 998 | | | | | | | | | | | | | | | | | 997 | | |
| 19 | 39.4 | 40.4 | 41.4 | 42.5 | 43.5 | 44.5 | 45.5 | 46.5 | 47.5 | 48.5 | 49.5 | 50.6 | 51.6 | 52 6 | 53.6 | 54.6 | 55.6 | 56.6 | 57.6 | 58.6 |
| | 997 | | | | | | | | | | | | | | | | | | | |
| 20 | 39 | 40 | 41 | 42.1 | 43.1 | 44.1 | 45.1 | 46.1 | 47.2 | 48.2 | 49.2 | 50.2 | 51.2 | 52.2 | 53.2 | 54.2 | 55.2 | 56.2 | 57.2 | 58.2 |
| | 997 | | | | 996 | | | | | | | | | | | | | | | |
| 21 | 38.6 | 39.6 | 40.6 | 41.7 | 42.7 | 43.7 | 44.8 | 45.8 | 46.8 | 47.8 | 48.8 | 49.8 | 50.8 | 51.8 | 52.9 | 53.9 | 54.9 | 55.9 | 56.9 | 57.9 |
| | 996 | | | | | | | | 995 | | | | | | | | | | | |
| 22 | 38 2 | 39.2 | 40.2 | 41.3 | 42.3 | 43.3 | 44.3 | 45.3 | 46.4 | 47.4 | 48.4 | 49.4 | 50.4 | 51.4 | 52.5 | 53.5 | 54.5 | 55.5 | 56.5 | 57.5 |
| | 996 | 995 | | | | | | | | | | | | 994 | | | | | | |
| 23 | 37.8 | 38.8 | 39.8 | 40.9 | 41.9 | 42.9 | 43.9 | 44.9 | 46 | 47 | 48 | 49.1 | 50.1 | 51.1 | 52.1 | 53.1 | 54.1 | 55.1 | 56.1 | 57.1 |
| | 995 | | | 994 | | | | | | | | | | | | | 993 | | | |
| 24 | 37.4 | 38.4 | 39.4 | 40.5 | 41.5 | 42.5 | 43.6 | 44.6 | 45.6 | 46.6 | 47.6 | 48.7 | 49.7 | 50.7 | 51.8 | 52.8 | 53.8 | 54.8 | 55.8 | 56.8 |
| | 994 | | | | | | | | 993 | | | | | | | | | | | 992 |
| 25 | 37 | 38 | 39 | 40.1 | 41.1 | 42.2 | 43.2 | 44.2 | 45.2 | 46.3 | 47.3 | 48.3 | 49.3 | 50.3 | 51.4 | 52.4 | 53.4 | 54.4 | 55.5 | 56.5 |
| | 994 | | 993 | | | | | | | | | | | 992 | | | | | | |
| 26 | 36.5 | 37.6 | 38.6 | 39.7 | 40.7 | 41.8 | 42.8 | 43.8 | 44.9 | 45.9 | 46.9 | 47.9 | 49 | 50 | 51 | 52 | 53 | 54 | 55.1 | 56.1 |
| | 993 | | | | 992 | | | | | | | | | 991 | | | | | | |
| 27 | 36.1 | 37.2 | 38.2 | 39.3 | 40.3 | 41.4 | 42.4 | 43.4 | 44.5 | 45.5 | 46.5 | 47.6 | 48.6 | 49.6 | 50.7 | 51.7 | 52.7 | 53.7 | 54.8 | 55.8 |
| | 992 | | | | | | | 991 | | | | | | | 990 | | | | | |
| 28 | 35.7 | 36.8 | 37 8 | 38.9 | 39.9 | 41 | 42 | 43 | 44.1 | 45.1 | 46.1 | 47.2 | 48.2 | 49.2 | 50.3 | 51.3 | 52.3 | 53.3 | 54.4 | 55.4 |
| | 992 | | | 991 | | | | | | 990 | | | | | | | | 989 | | |
| 29 | 35.3 | 36.3 | 37.4 | 38.5 | 39.5 | 40 6 | 41.6 | 42.6 | 43 7 | 44.7 | 45.7 | 46.8 | 47.8 | 48.9 | 49.9 | 51 | 52 | 53 | 54 | 55 |
| | 991 | | | | | 990 | | | | | | 989 | | | | | | | | 988 |
| 30 | 34 9 | 35.9 | 37 | 38.1 | 39.1 | 40.2 | 41.2 | 42.3 | 43.3 | 44.3 | 45.4 | 46.4 | 47.5 | 48.5 | 49.6 | 50.6 | 51.6 | 52.6 | 53.8 | 54.7 |
| | 991 | | 990 | | | | | 989 | | | | | | 988 | | | | | | |

TABLE IV.

INDICATIONS OF THE ALCOHOLOMETER.

APPARENT STRENGTH.

| Temperatures | 61° | 62° | 63° | 64° | 65° | 66° | 67° | 68° | 69° | 70° | 71° | 72° | 73° | 74° | 75° | 76° | 77° | 78° | 79° | 80° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0° | 66 | 67 | 68 | 68.9 | 69.9 | 70.8 | 71.8 | 72.7 | 73 7 | 74.7 | 75.6 | 76.6 | 77.6 | 78 6 | 79 5 | 80.5 | 81.5 | 82 4 | 83.3 | 84.3 |
| | 1013 | | | | | | | | 1014 | | | | | | | | | | | |
| 1 | 65.7 | 66.7 | 67.7 | 68.6 | 69.6 | 70.5 | 71.5 | 72 4 | 73.4 | 74.3 | 75.3 | 76.3 | 77 3 | 78.3 | 79 2 | 80.2 | 81 2 | 82 1 | 83.1 | 84 |
| | 1012 | | | | | | | | 1013 | | | | | | | | | | | |
| 2 | 65.3 | 66.3 | 67.3 | 68.3 | 69.3 | 70.2 | 71.2 | 72.1 | 73 1 | 74 | 75 | 76 | 77 | 78 | 78.9 | 79.9 | 80.9 | 81 9 | 82.8 | 83 7 |
| | 1011 | | | | | | | 1012 | | | | | | | | | | | | |
| 3 | 65 | 66 | 67 | 68 | 68.9 | 69.9 | 70 8 | 71.8 | 72 8 | 73 7 | 74 7 | 75.7 | 76 7 | 77.7 | 78.6 | 79.6 | 80 6 | 81 6 | 82.5 | 83.5 |
| | 1010 | | | | | 1011 | | | | | | | | | | | | | | |
| 4 | 64.7 | 65.7 | 66 6 | 67.6 | 68.6 | 69.5 | 70 5 | 71 5 | 72 5 | 73 4 | 74.4 | 75 3 | 76 3 | 77.3 | 78 3 | 79.3 | 80 3 | 81 3 | 82.2 | 83 2 |
| | 1009 | | | 1010 | | | | | | | | | | | | | | | | |
| 5 | 64.3 | 65.3 | 66 3 | 67.3 | 68 3 | 69 2 | 70.2 | 71 2 | 72.2 | 73 1 | 74 1 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 81.9 | 82 9 |
| | 1009 | | | | | | | | | | | | | | | | | | 1010 | |
| 6 | 64 | 65 | 66 | 67 | 68 | 68.9 | 69 9 | 70 9 | 71.9 | 72.8 | 73 8 | 74 7 | 75 7 | 76.7 | 77 7 | 78.7 | 79 7 | 80.7 | 81.6 | 82.6 |
| | 1008 | | | | | | | | | | | | | | | | | | 1009 | |
| 7 | 63.7 | 64.7 | 65 7 | 66.7 | 67.6 | 68.6 | 69 6 | 70 6 | 71 5 | 72.5 | 73.5 | 74 4 | 75 4 | 76 4 | 77 4 | 78.4 | 79.4 | 80 4 | 81.4 | 82.3 |
| | 1007 | | | | | | | | | | | | | | | | | | | 1008 |
| 8 | 63.4 | 64.4 | 65.4 | 66.4 | 67 3 | 68.3 | 69 3 | 70.2 | 71.2 | 72 2 | 73.2 | 74.1 | 75.1 | 76 1 | 77 1 | 78.1 | 79 1 | 80.1 | 81.1 | 82 |
| | 1006 | | | | | | | | | | | | | | | | 1007 | | | |
| 9 | 63 | 64 | 65 | 66 | 67 | 67 9 | 68 9 | 69 9 | 70 9 | 71.9 | 72 9 | 73 8 | 74 8 | 75.8 | 76 8 | 77.8 | 78.8 | 79 8 | 80.8 | 81.7 |
| | 1005 | | | | | | | | | | | | | | | | 1006 | | | |
| 10 | 62.7 | 63.7 | 64.7 | 65 7 | 66.7 | 67 6 | 68 6 | 69.6 | 70 6 | 71 6 | 72 6 | 73 5 | 74 5 | 75 5 | 76.5 | 77 5 | 78.5 | 79 5 | 80.5 | 81.5 |
| | 1004 | | | | | | | | | | | | 1005 | | | | | | | |
| 11 | 62.4 | 63.4 | 64.4 | 65.4 | 66 4 | 67 3 | 68 3 | 69 3 | 70 3 | 71.3 | 72.3 | 73 2 | 74.2 | 75 2 | 76 2 | 77.2 | 78 2 | 79 2 | 80.2 | 81.2 |
| | 1003 | | | | | | | 1004 | | | | | | | | | | | | |
| 12 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 72.9 | 73 9 | 74.9 | 75.9 | 76 9 | 77 9 | 78 9 | 79.9 | 80.9 |
| | 1002 | | | | | | 1003 | | | | | | | | | | | | | |
| 13 | 61.7 | 62.7 | 63.7 | 64.7 | 65.7 | 66.7 | 67.7 | 68.7 | 69.6 | 70.6 | 71.6 | 72.6 | 73.6 | 74.6 | 75.6 | 76.6 | 77.6 | 78.6 | 79.6 | 80.6 |
| | 1002 | | | | | | | | | | | | | | | | | | | |
| 14 | 61.3 | 62.3 | 63.3 | 64.3 | 65.3 | 66.3 | 67.3 | 68.3 | 69.3 | 70.3 | 71.3 | 72.3 | 73.3 | 74.3 | 75.3 | 76.3 | 77.3 | 78.3 | 79.3 | 80.3 |
| | 1001 | | | | | | | | | | | | | | | | | | | |
| 15 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| | 1000 | | | | | | | | | | | | | | | | | | | |
| 16 | 60.6 | 61.7 | 62.7 | 63.7 | 64.7 | 65.7 | 66.7 | 67.7 | 68.7 | 69.7 | 70.7 | 71.7 | 72.7 | 73.7 | 74.7 | 75.7 | 76.7 | 77.7 | 78.7 | 79.7 |
| | 999 | | | | | | | | 998 | | | | | | | | | | | |
| 17 | 60.3 | 61.3 | 62.3 | 63.3 | 64.3 | 65.3 | 66.3 | 67.3 | 68.3 | 69.3 | 70.3 | 71.3 | 72.3 | 73.3 | 74.3 | 75.4 | 76.4 | 77.4 | 78.4 | 79.4 |
| | 998 | | | | | | | | | | | | | | | | | | | |
| 18 | 59.9 | 61 | 62 | 62 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73. | 74 | 75.1 | 76.1 | 77.1 | 78.1 | 79.1 |
| | 997 | | | | | | | | | | | | | | | | | | | |
| 19 | 59.6 | 60.6 | 61.6 | 62.7 | 63.7 | 64.7 | 65.7 | 66.7 | 67.7 | 68.7 | 69.7 | 70.7 | 71.7 | 72.7 | 73.7 | 74.7 | 75.8 | 76.8 | 77.8 | 78.8 |
| | 997 | | | | | | | | 996 | | | | | | | | | | | |
| 20 | 59.2 | 60.3 | 61.3 | 62.3 | 63.3 | 64.3 | 65 4 | 66.4 | 67.4 | 68.4 | 69.4 | 70.4 | 71.4 | 72.4 | 73.4 | 74.4 | 75.5 | 76.5 | 77.5 | 78.5 |
| | 996 | | | | | | | | | | | | 995 | | | | | | | |
| 21 | 58.9 | 59.9 | 61 | 62 | 63 | 64 | 65 | 66. | 67 | 68.1 | 69.1 | 70.1 | 71.1 | 72.1 | 73.1 | 74.1 | 75.2 | 76.2 | 77.2 | 78.2 |
| | 995 | | | | | | | | | | | | | 994 | | | | | | |
| 22 | 58.5 | 59.5 | 60.6 | 61.6 | 62.7 | 63.7 | 64.7 | 65.7 | 66.7 | 67.8 | 68.8 | 69.8 | 70.8 | 71.8 | 72.8 | 73.8 | 74.8 | 75.9 | 76.9 | 77.9 |
| | 994 | | | | | | | | | | | | | | 993 | | | | | |
| 23 | 58.1 | 59.2 | 60.2 | 61.3 | 62.3 | 63.3 | 64.3 | 65.4 | 66.4 | 67.4 | 68.4 | 69.4 | 70.5 | 71.5 | 72.5 | 73.5 | 74.5 | 75.5 | 76.6 | 77.6 |
| | 993 | | | | | | | | | | | | | | 992 | | | | | |
| 24 | 57.8 | 58.9 | 59.9 | 61 | 62 | 63 | 64 | 65 | 66 | 67.1 | 68.1 | 69.1 | 70.1 | 71.2 | 72.2 | 73.2 | 74.2 | 75.2 | 76.3 | 77.3 |
| | 992 | | | | | | | | | | | | | | | | | 991 | | |
| 25 | 57.5 | 58.5 | 59.5 | 60.6 | 61.6 | 62.6 | 63.7 | 64.7 | 65.7 | 66.7 | 67.8 | 68.8 | 69.8 | 70.8 | 71.8 | 72.8 | 73.9 | 74.9 | 76 | 77 |
| | 992 | | | 991 | | | | | | | | | | | | | | | | |
| 26 | 57.1 | 58.1 | 59.2 | 60.2 | 61.3 | 62.3 | 63.3 | 64.3 | 65.3 | 66.4 | 67.4 | 68.4 | 69.5 | 70.5 | 71.5 | 72.5 | 73.6 | 74.6 | 75.6 | 76.7 |
| | 991 | | | | 990 | | | | | | | | | | | | | | | |
| 27 | 56.8 | 57.8 | 58.9 | 59.9 | 60.9 | 61.9 | 63 | 64 | 65 | 66 | 67.1 | 68.1 | 69.2 | 70.2 | 71.2 | 72.2 | 73.2 | 74.3 | 75.3 | 76.3 |
| | 990 | | | | | | 989 | | | | | | | | | | | | | |
| 28 | 56.4 | 57.5 | 58.5 | 59.5 | 60.6 | 61.6 | 62.6 | 63.7 | 64.7 | 65.7 | 66.8 | 67.8 | 68.8 | 69.9 | 70.9 | 71.9 | 73 | 74 | 75 | 76 |
| | 989 | | | | | | | | | 988 | | | | | | | | | | |
| 29 | 56 | 57.1 | 58.1 | 59.2 | 60.2 | 61.2 | 62.3 | 63.3 | 64.3 | 65.4 | 66.4 | 67.4 | 68.5 | 69.5 | 70.6 | 71.6 | 72.6 | 73.7 | 74.7 | 75.7 |
| | 988 | | | | | | | | | | | 987 | | | | | | | | |
| 30 | 55.7 | 56.7 | 57.8 | 58.8 | 59.9 | 60.9 | 61.9 | 63 | 64 | 65 | 66.1 | 67.1 | 68.2 | 69.2 | 70.3 | 71.3 | 72.3 | 73.3 | 74.4 | 75.4 |
| | 988 | | 987 | | | | | | | | | | 986 | | | | | | | |

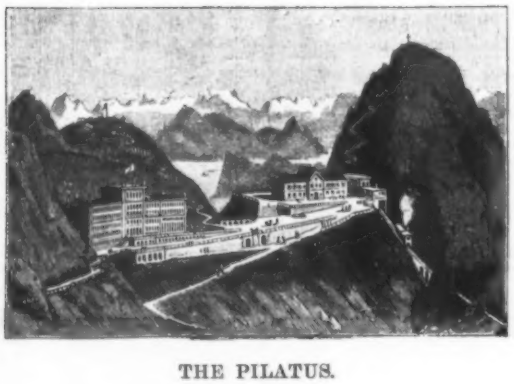
TABLE V.

INDICATIONS OF THE ALCOHOLOMETER.

APPARENT STRENGTH.

| Temperatures | 81° | 82° | 83° | 84° | 85° | 86° | 87° | 88° | 89° | 90° | 91° | 92° | 93° | 94° | 95° | 96° | 97° | 98° | 99° | 100° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0° | 85.2 | 86.2 | 87.1 | 88 | 88.9 | 89.9 | 90.8 | 91.7 | 92.6 | 93 6 | 94.5 | 95.3 | 96.2 | 97.1 | 98 | 98.8 | 99.7 | | | |
| | 1014 | | | | | 1015 | | | | | | | | | | | 1016 | | | |
| 1 | 85 | 85.9 | 86.8 | 87.8 | 88.7 | 89.6 | 90.5 | 91.5 | 92.4 | 93.3 | 94.3 | 95.1 | 96 | 96.9 | 97.8 | 98.6 | 99 5 | | | |
| | 1013 | | | | | 1014 | | | | | | | | | | | | | | |
| 2 | 84.7 | 85.6 | 86.6 | 87.5 | 88.5 | 89.4 | 90.3 | 91.2 | 92.2 | 93.1 | 94 | 94.9 | 95.8 | 96.7 | 97.6 | 98.5 | 99.3 | | | |
| | 1012 | | | | | 1013 | | | | | | | | | | | 1014 | | | |
| 3 | 84.4 | 85.4 | 86.3 | 87.3 | 88.2 | 89.2 | 90.1 | 91 | 91.9 | 92.9 | 93.8 | 94.7 | 95.6 | 96.5 | 97.4 | 98.3 | 99.2 | | | |
| | 1011 | | | | | 1012 | | | | | | | | | | | | | | |
| 4 | 84.2 | 85.1 | 86.1 | 87 | 87.9 | 88.9 | 89.8 | 90.8 | 91.7 | 92.7 | 93.6 | 94.5 | 95.4 | 96.3 | 97.2 | 98.1 | 99 | 99 9 | | |
| | 1011 | | | | | | | | | | | | | | | | | | | |
| 5 | 83.9 | 84.8 | 85.8 | 86.7 | 87.7 | 88 6 | 89.6 | 90.5 | 91.5 | 92 4 | 93.4 | 94.3 | 95.2 | 96.1 | 97 | 97.9 | 98.8 | 99.7 | | |
| | 1010 | | | | | | | | | | | | | | | | | | | |
| 6 | 83 6 | 84.5 | 85.5 | 86.5 | 87.4 | 88.4 | 89.3 | 90.2 | 91.2 | 92.2 | 93.1 | 94.1 | 95 | 95.9 | 96.8 | 97.8 | 98.7 | 99 6 | | |
| | 1009 | | | | | | | | | | | | | | | | | | | |
| 7 | 83.3 |

of corn cockle is handled in Hull, whatever its ultimate destination may be, and it sometimes occurs in feeding stuffs in far too large a percentage to be considered as an accidental impurity. Its use in admixture (as impurity or otherwise) with other feeding stuffs is strongly to be deprecated so long as there is the slightest risk attending its consumption by any domestic animal. Its detection is very easy, the peculiar rough husk of the seed being characteristic. The husk, after clearing with dilute sulphuric acid, and then with caustic soda, and examined under a low power of the microscope, will exhibit dark-red convoluted markings which distinguish it clearly from the husk of any other well known seed.—*Nature.*



THE PILATUS.

BRIDGE ON THE GOTHARD RAILWAY NEAR GOESCHENEN.

[Continued from SUPPLEMENT, No. 897, page 13336.]

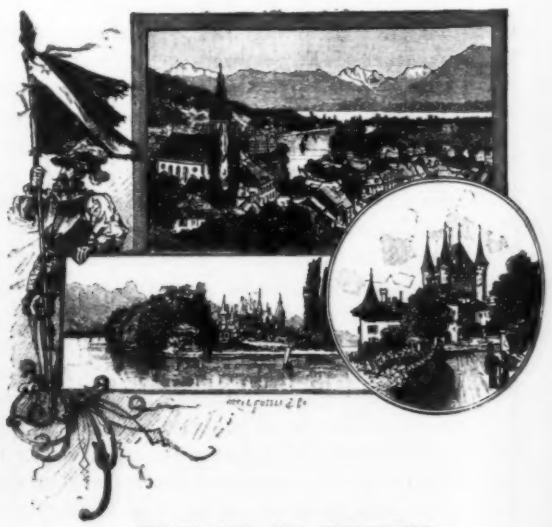
## THE TOUR OF SWITZERLAND.

FROM the Engadine most travelers return direct to Zurich, there rejoining the current of through travel to the Rigi and Lucerne. The knowing tourist does not go to Lucerne direct. He takes ticket (1 hour) to Zug, on the lake of that name, thence by boat to Arth at the easterly base of the Rigi and thence again by rail to the Rigi summit. At Goldau, where the ascent begins, one sees to this day the devastating effects of the enormous land slide of 1806, when a large piece of the Rossberg mountain came suddenly down, engulfing entire villages, and nearly five hundred souls. The ascent of the Rigi from this point is thrillingly interesting. The Klosterli and Staffel in turn are passed and the car finally comes to a standstill at the summit, the Kulm (5,500 feet above the sea), at a point where the view is incomparable and to which no attempt at description can do justice. The trip from Zurich to the Kulm is made in four hours, and most travelers pass at least one night on the summit to view the sunrise, and descend in the morning via the Kaltbad (whence runs a branch line to the Scheideck) to Vitznau and thence by boat to Lucerne, where in July and August, at the height of the season, one has perhaps a better opportunity than anywhere else in Switzerland to form a correct idea of the vast dimensions which this annual inroad of happy and well dressed visitors from all parts of Europe and America has of late years assumed. A walk on the quay at Lucerne of a summer evening is in itself a scene to be remembered. The lake stretching away in pensive quietness; Pilatus and the Rigi towering above it on either side; the quaint city in the background; the palatial hotels, the thronged thoroughfares, the crowds of promenaders representing every race and language and clime, the sounds of music from the hotel balconies, and over all a summer evening sky in which the blue is fading away into the soft moonlight—these are the recollections which memory brings back to every one who has been a midsummer lounger at Lucerne. But this is not all. Of all the Swiss lakes, that of Lucerne—or of the Four Cantons, as it is also called—excels in picturesque grandeur and variety of scenery. At Weggis, Vitznau, Seewen, Brunnen, Axenstein, Axenfels, Fluelen, Altorf, Seelisberg, Burgenstock, Gersau, Amsteg, Beckenried, Stoss, Morschach and all the other charming resorts upon or near its shores there are to be found unsurpassed accommodations, and lovely air and scenery. Opposite Lucerne you behold the Burgenstock, with palatial hotels and a funicular road leading from the station Kehrsiten on the lake, only twenty minutes steam from Lucerne. From Stanzstad, which is reached by boat from Lucerne, to the much frequented and populous summer resort Engelberg, which is reached in four hours and a half by stage. This lovely spot, which received its name, "The Mount of the Angels," from one of the Popes, is especially beneficial to all sufferers from nervous complaints.

Steamers run rapidly and frequently from Lucerne to all points on the lake. Connection is made with the St. Gothard railway at Fluelen, with the Rigi road at Vitznau, and with the Brunig and the Pilatus railways at Alpnach.

The Pilatus road, one of the most wonderful engineering achievements of modern times, is, during the present season (1889), first thrown open to public traffic, and adds another to the many attractions of Switzerland in general and of Lucerne in particular. Lucerne is also important as the northern terminus of the St. Gothard railway, that great highway connecting Central Europe in general and Switzerland in particular with the Italian lakes, Lombardy, Central and Southern Italy and the Riviera. The history of the construction of this wonderful triumph in engineering is a romance in itself. Begun in 1872, and completed ten years later, it remains and will remain for all time a monument to man's enterprise and energy. Some idea of the diffi-

VIEW OF LUGANO.



THUN AND ITS ENVIRONS.

culties encountered in its construction may be gained from the fact that on the main line, 176 kilometers in length, there are no less than 56 tunnels, with an aggregate length of 41 kilometers, or nearly one-quarter of the entire distance. The great tunnel between Goeschenen and Airolo is nine miles long, and required nine years' labor, and a million kilos. of dynamite in its construction. From end to end, the line is one continuous succession of the wildest and most picturesque

THE CASTLE OF CHILLON.

scenery, while the system and thoroughness of its management are simply perfect. As a route of summer travel its popularity is unbounded. Skirting the Lake of Lucerne, passing Schwyz, Brunnen, Fluelen, and Altdorf, it commences at Erstfeld the ascent of the mountain, and via Amsteg and Gurtnellen, reaches Goeschenen, where the diligence is taken for Andermatt, Hospenthal, the Gothard Hospice, Val Tremola, and the Furka and Oberalp passes. From Goeschenen, the great tunnel brings the tourist to Airolo, on the southern or Italian side of the mountain, whence through the picturesque valley of the Tessin, the railway makes an easy descent, to Bellinzona, Locarno, Lugano, Como, and all the charming resorts on the Lakes of Maggiore, Lugano and Como.

FROM LUCERNE.

None leaves Lucerne save with agreeable memories of its marvelous surroundings, its excellent hotels, its glacier garden, its historic "Lion" by Thorwaldsen, and its quaint cathedral, where, at the hour of the Angelus, the organ is wont to play and bring back to the stranger in the midst of his wanderings a calm sense of peaceful repose and thoughts of distant home and loved ones.

From Lucerne, travelers go over the Brunig Pass, taking the boat to Alpnach, as above stated, and thence by rail to Brienz, where boat is again taken for Giessbach and Interlaken, the key point for Lauterbrunnen, Grindelwald and all that wondrous mountain region beloved of Alpine climbers, and where, as a writer has aptly described it, an icy Lorelei seems to inhabit every peak, wooing the adventurous climber to destruction. One must in summer in person visit Interlaken, and the valleys to which it is the portal, in order to realize what enormous streams of strangers annually push their way into these out of the way regions, into every byway and corner of them, large numbers even going up as far as the glaciers. And it is indeed a fascination difficult to resist. Here are the Wetterhorn, the Jungfrau, the Schreckhorn, the Finsteraarhorn, and a series of others, their silvery summits sparkling in the bright sunlight, apparently so near at hand, yet in reality so far away and so difficult of access. Yet not so difficult but that annually by the aid of the trusty guides many sure-footed daring tourists scale their towering peaks, and return unharmed to their anxious friends in the valleys below. Many books have already been and still many more might be written upon the subject of Alpine climbing, and it may not be amiss in this connection to refer English and American readers to an excellent one recently published in London from the pen and pencil of Mr. C. D. Cunningham, an active Alpine climber, and Captain Abney R.N., and dedicated to Sir Francis Adams, C. B., late British Minister to Switzerland. But the book has yet to be written which shall serve to remind the Alpine tourist forcibly enough not to attempt an ascent unaccompanied by a guide. Many alas! have attempted ascents alone to the cost of their lives, and the time, it is hoped, is not far distant when the Swiss or individual cantonal authorities will prohibit by legal enactment the attempting of dangerous ascents without guides. These latter are a brave and hardy band of men, the stories of whose escapes and adventures in their struggles with the rough face of nature would make a volume more interesting than the wildest of Jules Verne's romances. Yet in outward appearance they are plain, simple, and unaffected, giving little token of the iron nerve and endurance which they are prepared, upon occasion, to display. At the Swiss National Exposition held at Zurich in 1883 there was no sadder or more speaking tribute to the simple heroism of these brave men than the various relics—such as broken robes, shoes, ice picks, belts, etc.—recovered after accidents in which one or the other of their number had lost their lives. All honor to the Alpine guides! No monument were too great or costly to commemorate their spirit of noble courage and self-sacrifice.

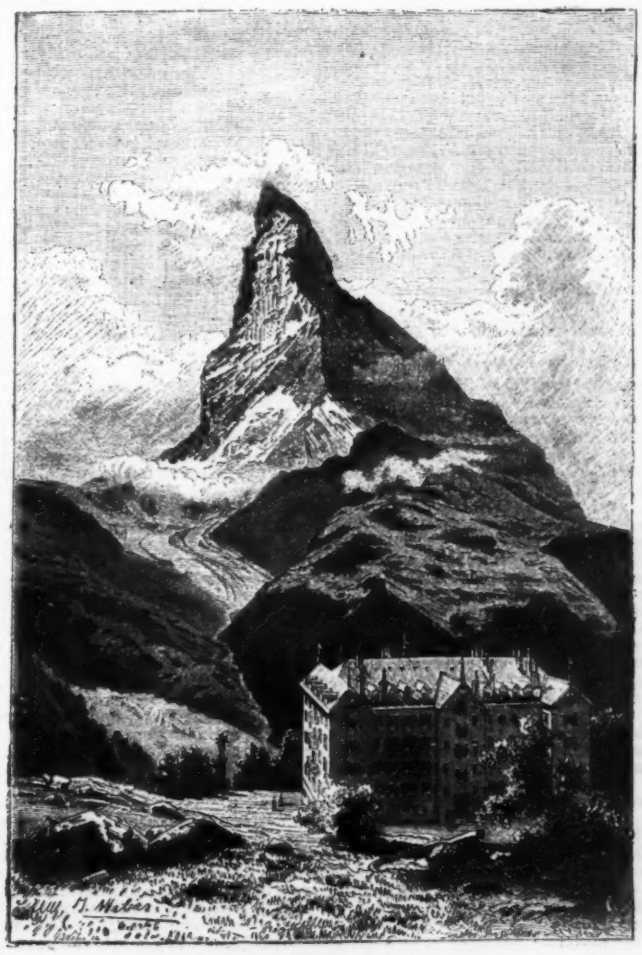
From Interlaken the stream of travel sets northward by way of the Lake of Thun. At Merligen the tourist takes the funicular road for the Curehouse of St. Beatenberg, half an hour distance on the heights. At Faulensee are the great mineral baths of that name. At Spiez, a village with a picturesque chatean, on the southern shore, connection is made for the alkaline-sulphur baths of Heustrich (one hour distant by diligence), Mulinen and Reichenbach. At Thun many find a quiet pleasant summer sojourn. Among the diligence routes from here is one leading via Latterbach to the medicinal baths of Weissenburg, picturesquely situated in a deep mountain gorge.

An hour and a half by rail from Thun brings one to the federal capital of Berne. A direct route also leads from Lucerne to Berne via the Entlebuch valley. Here a day may be passed most agreeably in visiting the parliament buildings and the ancient and highly ornate cathedral, in strolling about the city itself with its arch-covered sidewalks, in inspecting the well known bear pits, and, if time permit, driving up to the "Schaenzeli," a shaded pleasure garden on a high knoll, commanding a fine view of the city, the Aar, the surrounding country, and the entire range of the Bernese Alps. Here there is generally a concert, or a light operatic performance given on summer afternoons, and the visitor will find it a delightful place to while away the closing hours of his stay at Berne.

From Schaffhausen to Berne the tourist has been journeying through what is known as German Switzerland; but from here on to Geneva, the French language and customs grow constantly more dominant. It would be well for those who have time to stop over half a day at Fribourg, and see the massive cathedral with its famous organ, and the great suspension bridge, once said to have been the largest in the world.

But perhaps the greatest surprise of his entire journey across Switzerland awaits the tourist, as emerging from the darkness of a tunnel about one hour's ride beyond Fribourg, he beholds the beautiful Lake Leman—or the Lake of Geneva—spread out in its placid loveliness far below him, its terraced vineyard shores lined with picturesque villages, its waters dotted with steamers and lateen sails, and beyond it the Dent du Midi rearing its huge form as the background of the picture. It is a vision of entrancing loveliness, and all the more so for the suddenness with which it has broken upon the beholder. Scarce has he begun to realize it, when the train comes to standstill at Lausanne ("set on a hill," and from its terraced streets and avenues the visitor looks out upon not only the lake

THE CHURCH AT MONTREUX.



THE MATTERHORN.

itself, but the fair lands of Savoy beyond it. Here is the Swiss National Palace of Justice, an imposing edifice; here the famous cathedral consecrated in the thirteenth century by Pope Gregory X.; here the spot to which in 1536 came Calvin to take part in the discussion which finally separated the Canton of Vaud from Catholic Savoy; here later dwelt Gibbon, the great English historian, and here at the present time are to be found large colonies of English and American sojourners, attracted hither by the educational facilities and the charming location of the city.

As a railroad center also Lausanne is important, being the point from which no less than seven different lines take their departure. The line of tourist travel for Vevey, Montreux, Territet, Chillon, Villeneuve, Bex, St. Maurice, and Martigny and the Rhone glaciers leaves here the main line to Geneva, and gradually descending to the level of the lake, skirts its shore, passing through a continuous settlement of villas, pensions, and hotels until the upper or eastern end of the lake is reached, where it branches off into the valley of the upper Rhone, with its ultimate terminus at Brigue. The entire route is a pleasure jaunt, whether one make it all by rail or, alighting at Vevey, take the boat, run over to Evian and thence back to Territet, Chillon, and Villeneuve. From Territet, the funicular road ascends the mountain to Glion at its summit, from Vevey an electric tramway skirts the lake shore as far as the historic castle of Chillon, which is perhaps to the educated visitor the most interesting spot in the entire neighborhood; at Villeneuve, just beyond, one has opportunity to note the oft remarked contrast in color between the waters of the lake and the glacial Rhone which empties into it near at hand.

Beyond this point nature assumes another of her varied forms. The scenery in the Rhone valley gradually grows wilder and wilder, the vineyards are replaced by rocky barren slopes until on reaching Visp the traveler finds himself within four hours by diligence of Eggishorn and the Rhone glaciers, beloved of Alpine tourists and climbers, and celebrated in song and story for centuries past. At Zermatt, the point whence the ascent to the Matterhorn with the guides begins, one is unavoidably reminded of Mark Twain's inimitable description of his experience there in "A Tramp Abroad."

*(To be continued.)*

## AN AGE OF INVENTION.

AN ANALYSIS OF THE ANNUAL REPORT OF THE UNITED STATES COMMISSIONER OF PATENTS.

GREAT ACTIVITY AMONG MEN OF MECHANICAL TALENT—NEW DEVICES AND THOUSANDS OF IMPROVEMENTS UPON FAMILIAR ONES—CURIOUS AND INSTRUCTIVE FACTS.

THIS paper is a summary as well as analysis of the official report of the Commissioner of Patents just published. The report was laid before the United States Senate by the Vice-President, February 1, 1892, referred to the committee on patents, and ordered to be printed. It is a massive volume of 775 pages, 11 by 7¾ inches in size, and contains 800,000 words and 1,100,000 figures.

No public document speaks more clearly of the material progress of the American people than this one. The applications of science to industry during this century far exceed in importance and number all that had been done during the historic period down to the time of the death of Washington. Those who can look back to the human labor of fifty years ago readily appreciate the new order of things. Mechanical appliances in agriculture alone enable the farmer of to-day to do four times as much in giving farm products to the world as his grandfather was able to do, thus liberating millions of men to engage in mechanical industry, and a million for the work of transportation.

The markets of fifty years ago were merely local, but railways and steamships have given the farmer the whole world as his market. Mechanical industry is a characteristic feature of modern life, and has become well nigh universal among the peoples of the Aryan race. The freight carried in 1892 by our railways alone was equivalent to carrying 1 ton 1,350 miles for every man, woman and child of our population. The adult male population of our country, acting as porters, and each carrying 50 lb. 10 miles a day, could not perform a hundredth part of the work done by our freight trains last year. The work of inventors in subjecting the forces of nature to man's uses is of inestimable value, as seen in the services rendered by railroads alone.

### EARLY PATENTS.

The first patents in this country were granted in the year 1790, and there were only three of them for that year. The first one was to Samuel Hopkins, for a process of manufacturing "pot and pearl ash." The second was to Joseph Sampson, for manufacturing candles, though the method of dipping candles was very generally followed for sixty years after that. The third patent was awarded to Oliver Evans, for a method of manufacturing flour and meal. Thirty-three patents were granted in 1791, 9 in 1792, 20 in 1793, 21 in 1794, 11 in 1795, 37 in 1796, 51 in 1797, which appears to have been a year of unwonted activity in the demand for patents, as only one week passed without granting one. In 1798 the business fell off one-half, only 25 patents being awarded, and in 1799 39 were granted. Among the patents for these ten years we find 16 for nail making machines, though nearly all the nails used even during the first years of this century were made by hand, as blacksmiths formerly made horse shoe nails.

During this period only 2 patents were issued for washing machines, but 128 such machines were patented last year, and several thousand patents had already been issued for such devices. We do not find a single patent issued for a churn during these ten years, though the pump was patented 9 times. Here we note that Eli Whitney's cotton gin was patented March 14, 1794. Hodgen Holmes, of Georgia, also patented a cotton gin two years later, March 12, 1796; and John Murray, of Georgia, also patented one December 23, of the same year. John Fitch's patent for propelling boats by steam was taken out August 26, 1791.

During the last ten years of 1790, 5 patents were awarded for candle making, 12 for all kinds of mills for sawing or grinding, 12 where steam was the leading word in the titles, 1 for the manufacture of boots, 1 for a bed, 4 for handling and treating flax, 5 for distilleries, 5 for thrashing machines, 7 for all kinds of mud, tile and brick making devices, 11 for methods of propelling boats, 3 for the pendulum, 2 for the windmill, 4 for paper making, 3 for looms and weaving, 4 relating to iron and steel, 4 for iron stoves, 3 for cleaning rice, 2 for printing presses, 3 for bridges, 3 for pills, 2 for bread and dough making, 3 for salt making, 4 for saws, and 2 for tobacco making. During these ten years 1 patent was issued for each of the following articles: A bell, wire, furnace, piano, plow, clock, saddle, boat, broom, cultivator, comb, chimney, window, soap, a fire engine, and a tooth extractor. During the last decade of the last century only 249 patents were issued by our government. Even as late as Jefferson's administration, cabinet meetings were quite frequently called to consider and pass upon applications for patents. We are now issuing a thousand patents where one was issued during the last ten years of the last century.

Thousands of patentees, for only a brief period, enjoyed the ownership of the property their talents created, and even during that period they realized only a very small portion of the benefits flowing from their inventions, the public reaping the larger share in added comfort and lower prices. In order to induce able men to give their time and talent to inventive work, Congress was authorized in the Constitution to secure "for limited times to authors and inventors the exclusive right to their writings and discoveries," in order "to promote the progress of science and useful arts," and all can now see how grandly the useful arts have been promoted by our patent laws. While James Watt made money out of his steam engine patents, the amount he made, compared with the benefit he conferred upon the human race and the wealth his inventions created, is an exceedingly small fraction of the one-thousandth part of a dollar. We can have no better illustration than this, that the great and permanent value of inventions and discoveries goes to the human family, and lifts the whole race to higher levels.

### STATISTICS.

Exclusive of applications for the registration of trademarks and labels, the total number of applications received at the Patent Office for the year, including mechanical applications, designs, and reissues, 40,552. The total number of patents granted was 23,244, and the total number of registrations was 1,899. The total receipts of the office for the year were $1,271,286, and the expenditures were $1,139,713, leaving a surplus of $131,000 to be turned into the Treasury of the United States. The balance now in the Treasury to the credit of the patent fund is over $4,000,000. During the year 1,928 patents were granted to citizens of foreign countries, 1,538 of them being from England, Germany, Canada, and France. Persia, Peru, Portugal, Roumania, Tasmania, Turkey, Bulgaria, Cape of Good Hope, Ceylon, and Chile asked and obtained one patent each. Japan, San Domingo, Java, Scotland, and South Africa took two each. Brazil, India, and Queensland three each, and South Australia took four.

It is curious to note that while Mississippi takes one patent for every 20,469 of her population, Connecticut takes one for every 1,018 of hers. South Carolina takes one patent for every 23,490 of her population and Massachusetts one for every 1,055 of hers. North Carolina takes one for every 21,288, and Rhode Island one for every 1,191. Georgia takes one patent for every 14,817 persons, and New York one for every 1,635. Alabama took one for every 18,457 and Illinois one for every 1,944. Where we find the largest general intelligence, the widest diffusion of the benefits of free schools, there we find the largest inventive activity and the best fruitage of mechanical talent.

Many great American inventors have earned world-wide fame: Fitch and Fulton for steamboats; Whitney for the cotton gin; Evans for milling machinery; Whittemore and Jenks for looms; Terry, Ives and Jerome for clocks; Lorillard for tobacco making; Edwards for leather making; Wood for plows; Blanchard for lathes for turning irregular forms; Spencer for geometrical lathes; Hoe, Adams and Gordon for printing presses; Collins and Root for ax making; Ames for shovels; Woodworth for wood machinery; Fairbanks and Howe, scales; Howe and Crosby for pin making; Knott and Mott for stoves; Stuart for sugar refining; Baldwin and Winans for locomotives; Pullman for sleeping cars; McCormack and Ketchum for reapers; Colt, Sharp, Spencer, Smith and Wesson for firearms; Phillips for matches; Wells for hats; Goodyear for India rubber; Ericsson for naval construction and hot air engines; Howe, Wilson, Singer, Gibbs, Grover and Baker for sewing machines; Morse for the telegraph; Tatham for lead pipe; Whipple for screws; Chickering and Steinway for pianos; Burden for horse shoes; Yale for locks; Roebling for wire cables; Corliss for steam engines; Disston for saws; Stephenson for horse cars, and Gatling for quick-firing guns.

The following is a summary of the most important patents of the year as detailed in the commissioner's report: 12 patents were issued for methods of manufacturing acids, 1 for an abdominal supporter, while adding machines took 19 and addressing machines 6. Advertising devices, inclusive of one advertising wagon, were awarded 13 patents. The air brake was found so imperfect as to afford room for 20 new patents. The word "air" begins the titles of 53 different patents. Four were awarded for albums and 4 for alarm locks. Alloys, three of them for aluminum, took 10 patents, and 2 were given for processes in the manufacture of aluminum itself. Amalgamators needed only 8 patents, processes for forming articles from amber took 4, processes for preparing ammonia 9, anchors 5, and the andiron only 1. Thirty-one animal traps were patented and 1 horn tip, and 1 nose band for animals. The annunciator was awarded 24 patents, an artificial arm, an ant trap and an anti-snoring device each took 1. The armature received 21 patents, an asparagus buncher 1, the atomizer 14, and the carpenter's auger 10. A walking automaton was thus protected, and 6 patents were given for automatic gates. Awnings received 9, and the ax 9, while axles of all kinds took 103 patents, 6 of them being for bearings, 16 for boxes, 7 for car axles, 12 for axle lubricators, and 11 for vehicle axles.

Baby walkers took only 2 patents, and baby jumpers only 5. Under the head of "bag" 27 patents are recorded, 5 of them being for fasteners and 9 for holders. Baking pans, tins and powders were given 13, while under the head of bales and baling 58 are recorded, 43 of them being for baling presses and 14 for bale ties. The ballot box found room for only 4 patents, band cutters and feeders 10, while the banjo was awarded 12, one of them being for a "banjo tail piece." Forty-eight patents have titles beginning with the word "bar," and there are 16 classes of them, such as car drawbar, cutter bar, sickle bar, etc. The barber's chair needed only 3 patents, the barrel, with tools and devices for making it, took 40, while the decadence in base ball is seen in only 1 patent for a base ball mask. Basins of all sorts took 11 patents, the basket and devices pertaining to it took 20. Under the head of "bath and bathing" we find a record of 15 patents, while under 10 classes of batteries we note 67 patents, 20 being for secondary batteries. The bean gives its name to only 2 patents for trimming and cutting that useful plant which Pythagoras so long ago condemned. Under the title "bearings" 45 patents are recorded, 22 of them being for ball bearings and 9 for anti-friction bearings. Beds and bedsteads carry off 108 patents, 25 of them being for folding beds, 5 for bed sofas, 15 for bed springs, and 21 for the bedstead alone. The beehive needed only 8 patents, methods of making, cooling and drawing beer 12, while the bell needed 37. Belts and belting were awarded 59, 10 of them being for that folly known as the electric belt, and 14 for belt fasteners. Only 1 patent was awarded the berry box, while berths of various sorts took 5. Unabated interest in the bicycle continues, and that vehicle, with its saddles, attachments and supports took 104 patents, or just 2 a week for the year. Billiard tables and cues were awarded 15, the bier only 1, while binders took 13, bird cages 3, and bits of eight sorts 21. The blast furnace was given 7 patents, blasting devices 8, and blinds 20. Under "block" we have a record of 26 patents, and they are classified under 15 heads as ceiling, hoisting, pulley and paving blocks. Blowers required 6, and 80 patents under 26 classes contain the word "board" in their titles, game boards numbering 18, wash boards 16, and ironing boards 8. Under the title "boat" only 13 patents were given. Bobbins took 8, and under 23 heads the boiler was awarded 174 patents, 57 of them being for steam boilers, and 14 for feeders and cleaners. Bolts of all sorts claim 51 patents, inclusive of improvements in machinery for making them. The book and books were given 75, and they include improvements in blank work, devices for binding and such articles as racks and rests. The boot and machinery for making it required only 48 patents, manufacturing borax 1, while boring tools and devices were awarded 24. The word "bottle" begins the title to 70 patents, 5 of which are for nursing bottles, 21 for bottle stoppers, 5 for bottle washing devices, and 5 for bottle filling machines. Under 70 different classes, such as coin, signal, mail and music, the "box" was awarded 287 patents. Twenty-three patents were given for 18 kinds of braces, 5 for bracelets, and 27 were taken for 18 classes of brackets. Braiding machines received 12 patents, while the brake took the large number of 201, 87 of them being for cars, and 32 for vehicles and wagons.

Conveniences for bread making received 10 patents; brick and devices connected with their manufacture were given 60, or one a week; 12 of these were for kilns, and 19 were on brick machines. Patents whose titles contain the word "bridge" number 28, 12 of these being for gates and 2 for suspension bridges. The broom was given improvements worthy of 21 patents, and the brush of 57. The buckle, which was already covered by many hundred patents, obtained an additional patent every week in the year; and two of them were for shoe buckles and 14 for suspender buckles. Buildings and appliances use in their construction took 19 patents, bullets 5, and the bung extractor and the bung-hole one each. Burglar alarms were given 10 patents, and burial apparatus, including caskets, 13. Twenty-one classes of burners were awarded 98 patents, 27 of them being for gas burners, 20 for hydrocarbon burners, 10 for lamp burners and 15 for vapor burners. The bustle merited only one patent. Butter, inclusive of machines, extractors, lifters and workers, was given 24, and the patents in whose titles the word "button" is most prominent number 84, and of these 9 are for fasteners, 8 for setting machines and 6 for separable buttons. Twenty-six patents were issued for cables, 11 of them being for cable grips. One patent was given for a bird-cage perch. The calendar took 22, calipers 5, and a tool for dehorning calves 1. The camera was patented 37 times, and under eight different heads; 23 of these were for the photographic camera. Sixteen kinds of cans, inclusive of devices for making, capping, filling and opening, required and received 78 patents. An altar candle, 3 candle holders and a sulphur candle, all received patents. The candlestick called for 3, the manufacture of candy 3, the handling of sugar cane 11, and the capsule and capsule-making machinery took 7. The patents in whose titles the word "car" is most conspicuous number 829, or over 2 for every day in the year; of these, 87 are for car brakes, 5 for buffers, 302 for car couplers, a car coupler now being patented every day in the year; 30 for car doors, 16 for dumping cars, 10 for car replacers, 16 upon seats, 6 upon springs, 10 upon steps, 9 upon stock cars, 4 upon sand boxes and 21 upon car wheels. The word "card" is prominent in the titles of 25 patents. Carding machines were awarded 27, carpets 44, inclusive of 12 for fasteners, 11 for stretchers, and a few for devices for cleaning. The carriage took 60 patents, the cart 50, 40 of them being for road carts. The cartridge, including fillers, loaders and carriers, took 28 patents. Carving machines, comparatively new devices, were given 12 patents. A hundred were given under 45 classes where the term "case" is the leading one in the title. The word "cash" begins the titles of 121 patents, 14 of them for recorders, 29 for registers and 54 of them for registers and indicators. The caster was patented 18 times; casting and casting apparatus needed 32; cattle dehorning implements 4; cattle guards 8; ceilings 9, and cement and its manufacture 16. Centrifugal machines asked for and took 14 patents. Under the head "chain" 32 patents are recorded. Twenty-nine kinds of chairs took just 100 patents. Cheese holders, boxes and cutters were awarded 8, and one was given for a device "for perforating Roquefort

cheese." The chimney needed 12, the chocolate pot 3, and the chopping knife only 1. The chuck took 36 patents, 14 of them being for drills. In this period of large central dairies inventive talent has withdrawn itself to such an extent from the churn that this useful article took only 56 patents, or one a week. The cider mill took 3, cigars and devices for making them took 78, and cigarettes 15, 11 of them being for cigarette making machines. Thirty-nine classes of clamps received patents; the simple clevis took 4 and the clock 54, half of them being for electrical attachments. "Cloth and clothes" are the pivotal words in the titles of 104 patents, 22 of them being for driers, 24 for lines, 8 for pins, 6 for pounders and 12 for wringers. The clutch merited 56 patents, 43 of them being for the friction clutch. Coal and devices for mining and handling it were given 21 patents; the cock 28, coffee pots, mills and canisters, and apparatus for preparing infusions of it, took 28. The coffin and its lids, fasteners and handles were given 11 patents. Coin holders, distributors and receptacles merited 23; coke and its manufacture 8, the collar 39, of which 19 were horse collars, and the combination lock 8. The commutator needed 25 patents, while the ship's compass answered its purposes so well as to need but one. Concentrators were given 6, condensers 20, conveyers 17, and cooking devices and apparatus 17. Chicken coops asked for only 3 patents, copy-holders 6, copying devices and presses 15, cork cutting and wiring machines 10, the corkscrew only 5, and a machine for making corn-cob smoking pipes only 1. Twenty-nine titles of patents contain as the leading word "corn," and 9 of these are for shellers and 4 for poppers. The corset took 21 patents and cosmetics 3. Cotton is the leading word in 70 titles of patents, these being for choppers, cultivators, cleaners, gins, pickers and pressers. The crane gets 27, the crate 17, and the crematory closet and cremation furnace 5. Four patents were awarded for improvements upon the crupper of a harness. Cuffs and cuff-fasteners and holders merited 17; while the farm and field cultivator took 116 patents. Curling irons needed only 5, while the curry-comb called for 11. Curtains took 40 patents, 10 of them being for fixtures and 11 for curtain poles. Sixty-four classes of cutters were given patents, and the damper took 15.

Decorticating machine improvements merited 5 patents, distilling apparatus 10, ditching machines 6, and doors 103, of which 30 were for checks, 15 for hangers, 8 for door securers, and 9 for springs. A dough mixer, a dough raiser, and a dough board each took a patent. Draught devices received 34 patents, 20 of them being for equalizers. Drawbars secured 9, dredging machines 8, dress forms 6, and 15 kinds of drills were given 52 patents. Drying machines and devices were awarded 35, the dumb bell 2, dust collectors 21, dust pans 5, and dyes and dyeing apparatus 49. The dynamo was improved so as to get 19 new patents. Three kinds of ear rings and 1 ear piercer were patented. The easel required 5 patents, the eaves trough 11, egg crates, carriers, beaters and holders were given 25. Inclusive of those for the telegraph and telephone, the large number of 1,643 electrical patents were awarded, or 4½ a day for every day in the year. Among these we find 13 for electric cables, 35 for conductors, 15 for regulators, indicators, etc., of electric currents, 8 elevators, 7 heaters, 30 for electric lighting systems 39 on dynamo electric machines, 98 for electric motors, 53 for switches, 8 for electric wire conduits, 42 relating to electric wires, 6 for systems of distribution, and the others are for devices by means of which electricity is generated or applied. The application of electricity to the uses of man, thereby opening a new and large domain of industry and creating a new profession, "electrical engineering," has been made almost entirely during the past fifteen years, and the inventive and industrial activity in this direction is nowhere more distinctly indicated than in the Patent Office.

Elevators and features pertaining to them took 148 patents, or three a week. These vertical railways are what render the upper stories of high buildings habitable. Elliptical springs found room for 2 more patents, and an embalming mixture and an embalming board each took one. Embossing machines and devices were given 11 patents, embroidering machines 14, enameling processes 4, and end gates 19. The titles of patents in which the term "engine" is most prominent number 303, of these 13 are for dental engines, 20 for gas engines, 10 for pumping engines, 13 for rotary engines, 67 for steam engines, 10 for traction engines, 11 for vacuum engines and 8 for wind engines. In all 45 classes of engines found room for improvements which merited patents. Seven engraving machines were patented, and 54 devices for making envelopes were awarded patents. Evaporating devices required 20 patents, excavators 5, excelsior making machines 5, exercising apparatus 12, explosives 7, extension tables 9, and extractors of 14 classes, from those for bungs and corns to those for spikes and stumps, were given 34 patents. The eye-glass received 13 patents, fabrics of 10 varieties 45; fans 18, the fanning mill 6, and devices for taking and recording fares 21, 11 of them being for fare registers. The farm gate obtained only 7 patents, faucets of all sorts 27, and a feather renovator 1. The word "feed" begins the titles to 75 patents, and they are for bags, cutters, racks, rollers, troughs, heaters and purifiers. The fence stands 6 in the records with 182 patents, or about 4 a week, 10 of them being for barbed wire fence, 21 for fence making machines, 24 for fence posts, 26 for fence wire, and 11 for dyes for making barbed fences. Fertilizers asked for 13 patents, and 23 were given for fertilizer distributors. Fourteen patents were awarded for treating fibrous plants so as to get the fiber. The "fifth wheel" was given 12 patents, files of all sorts, from steel to paper, needed 58 patents. Devices for filtering claimed 60 patents, finger devices 9, 5 of them being for finger rings. Fire alarms took 19 patents. The term "fire" is most conspicuous in the titles of 173 different patents, 60 of them being for fire escapes, 19 for alarms, 23 for fire arms, 23 for fire extinguishers and 5 for kindlers.

A patent was issued for a "fish-bite alarm," while the terms fish and fishing enter into the titles of 42 patents, 10 being for hooks, 8 for reels and 5 for rods. Under "floors" and "flooring" we find 17 patents, under "flour" 20, under "flower," inclusive of pots and holders, 8. The flue cleaner took 9 patents, fly papers, brushes and poisons 10, and a "fly frightener" 1. Feet warmers had 2 patents, the forceps 1, freezing apparatus 1, fruit pickers, gatherers and pitters 38, and fumigating trees and plants 1. Forty-one classes of furnaces were given 159 patents, 17 of them for boiler furnaces, 12 for hot air furnaces, 5 for roasting ores, 5 for consuming smoke, and 2 for burning garbage. Under the head of "fuse" we find 11 patents, and a hundred patents are given for 34 classes of gauges.

The galvanic battery was patented 18 times. Under the heading of "games" we find a record of 73 patents, and among them are 18 game boards. Under the heading "garment" 32 patents were given, 5 of them for hooks and 12 for supporters. The garter and a garter fastener each took a patent. Gas making and fixtures seem to have been found imperfect enough to need 157 patents, 27 of them being for burners, 6 for motors, 8 for meters, and 40 for making or producing various kinds of gases. The gate, which was supposed to be nearly perfect half a century ago, asked for and obtained 108 patents. These gates are classed under 20 heads: 60 of the patents being for devices and improvements upon fence gates. Under "gear" and "gearing" 20 patents were recorded. The "geodetic altazimuth" and a girth fastener each took a patent. Under glass and glassware 52 patents are enumerated; these include devices, machinery and tools used in the manufacture of glass. The globe gets 5 patents, the glove and glove machinery 21, glycerine 5, gold, its extraction and uses 17, the gong 9, and the gopher trap 1. Governors, exclusive of those of States, require 26 patents, 10 of them being for the steam engine.

Under the head of grain 112 patents were issued, 21 of them being for binders, 3 for driers, 17 for drills, and 12 for meters. The grate took 29 patents, the grater 3, and grinding apparatus and mills 55; the grindstone had 4, gripping devices 4, guano distributors 2, and the guitar 7. The gun took 80 patents, 3 of them for air guns, 7 for breech loaders, 5 for magazine guns, 4 for pneumatic guns, and 6 for gun sights.

Hair pins, curlers and tonics needed 17 patents, the halter 5, a ham cover and a ham stuffing machine 1 each. The hame took 20 patents, the hammer 20, and the hammock 11. Twenty-two kinds of handles and 27 classes of hangers were awarded patents. The harness required 35, the harp only 2, while the harrow asked for 80. Harvesters took 97, of which 38 were for corn harvesters. A patent was granted for a hat band, and 36 were for improvements and devices for making hats. Under the title "hay" 74 patents were granted, 5 of them for hay forks, 7 for loaders, 9 for hay presses, 7 for hay racks, 10 for rakes, and 7 for stackers. Under "heat" and "heating" 67 patents are recorded, and patents were also issued for 24 other classes of heaters, such as car heaters, gas heaters, and water heaters. Machines for trimming, nailing and burnishing boot and shoe heels took 40 patents, while the hinge required 48, hitching devices and posts 15, the mortar hod and hobby horse 1 each. The hoe required 8 patents, and 1 was given for a "hog trap," 1 for a hog trough, and 1 for a device for holding hogs' snouts. Hoisting mechanism and apparatus required 48 patents, and several hundred were taken for 150 different kinds of holders. Hominy manufacture took 2 patents, hoof expanders and hoof pads 7, and 28 kinds of hooks, from coat to whiffletree hooks, took patents. Under the head "horse" 63 patents were granted, including everything from blankets and halters to tail holders. The horse shoe had improvements warranting 38 patents. Hose, hose coupling, nozzles and supports 51, hot air and hot water devices 34, the hub and its manufacture 25, the hydrant 16, hydraulic devices 15, and hydrocarbon furnaces and apparatus for burning, inclusive of 20 burners, took 29, and the hydroscope 1.

Ice freezers, hooks, cutters, tongs, picks and machines needed 63 patents, incrustation preventives 4, incubators 13, indexes 16, and protection was also granted for improvements on 33 kinds of indicators. Ink, including 9 ink wells and 23 ink stands, took 41 patents. An inseam trimming machine 1, while insect traps, catchers, powders and insecticides required 16. Insoles 4, insulators and insulating 64. The titles "iron" and "ironing" are prominent in 56 patents, 12 of them being for ironing machines and 10 of them for ironing tables.

Jewelry and machines for its manufacture took 15 patents. Twenty-one classes of joints were patented, and journals, inclusive of 14 bearings and 10 boxes, received patents. One was issued for making jute bagging. The word "key" figures in 29 patents and the knife in 43. Improvements in knitting machines took 70 patents, knobs 34, kneading machines 4, knobs and attachments 24, a knot-tying device and kraut cutter 1 each. Labeling devices needed 9, the ladder 43, the ladle 2, while the lamp, presumed to be nearly perfect, took the large number of 285, of which 173 were for electric lamps, and lanterns required only 36. The last and lasting machines took 24, the latch 38, metallic lathing 14, while the lathe required 51. Lawn sprinklers and sweepers needed 10 patents, and 35 were issued for handling and working leather. The artificial leg took 3, while the letter box required 61. Levels took 20, life buoys and preservers 9, lifting jacks 36, while patents were given for 15 classes of other lifters.

Five liniments were protected by patents, and methods of purifying, testing and cooling liquids needed 17. Forty-five different classes of locks took 222 different patents, the locomotive found room for 49, 8 of them being electric. Thirteen patents were taken out for loading, turning and lifting logs. The loom had not been perfected sufficiently to avoid 140 new patents, the shuttle alone taking 26. The lounge had 4, the low water alarm 4, and 15 kinds of lubricators were awarded 73 patents. Macaroni needed only 1 patent, the mail bag 24, 8 of them being for catchers. Forty-six titles of patents contain the word "mail," 1 manger, 1 mangle and 1 manicure implement each were patented. The word "match" enters into the title of 16 patents, 7 of them being for boxes. Matrix-making devices took 15, measuring devices 66, while meat cutters and tenderers needed 20 patents. Forty-one mechanical movements were patented, and 1 merry-go-round. Under titles containing the words "metal and metallic" 97 patents were granted. Meters of 14 kinds took 63 patents, a dissecting microscope 1, milk cans, coolers, heaters and testers 31, while 31 kinds of mills, from bark mills to wind mills, took 183 patents. Even in this period of roller mills 3 mill stones were patented. Mining machines and devices had 26, the mirror 5, the miter box 5, and a patent was issued improving the flavor of molasses. Four were given for mole traps, 13 for money boxes and drawers, 4 for monkey wrenches, and 13 for mops and mop wringers. Thirty-three classes of motors took 202 patents, "a mousing and safety hook" 1, and mowing devices 51, of which there were 15 lawn mowers and 22 mowing machines, and the muff took 1. Mucilage, with boxes, holders and spreaders required 7 patents. Musical instruments, devices and conveniences 77, and a patent was granted whose title is "a self-acting mule." The nail, nailing machinery and nail implements required 46 patents. Neck scarfs and neck-tie fasteners 21, needle threaders 2, treatment of nickel ores 4, nippers 6, the nose bag 2, the nozzle 6, and 1 was given for a nose ring for animals. Under titles where "nut" is the leading word 71 patents were given, 56 of them being for nut locks. The oar got only 2, while under titles beginning with oil we find 47, 8 of them being for burners and 12 for cans. Improvements upon ordnance needed 21 patents, 9 of them being for breech loaders. Under the heading "ore" we find 72 patents recorded, 22 of them being for concentrators, 5 for thrashers, 5 for furnaces, 5 for washers and 12 for separators. The organ, from pedals to pipes, needed 26 patents, the ovens 16, the overshoe 7, and an artificial oyster bed 1.

Packing of all kinds, mostly for piston rods, took 44 patents, padlocks 18, pails 12, 5 of them being for the dinner pail, paints with buckets and pots 28, while 14 kinds of pans, from ash and baking to salt and vacuum pans, took patents. The pantaloons hanger and stretcher seems to have been worthy of only 2 patents. Under the heading "paper" 188 patents were recorded, 19 of them being for paper bag machines, 20 for paper boxes, 14 for paper cutting machines, 5 for folders, and 35 for roll paper holders and cutters. A patent was issued for making Paris green, 1 for a paste pot, 1 for a pea huller, and 1 for a peanut picking machine. Pavements took 13, pegging jacks 3, and that manual abomination the fountain pen 13. Pens, their holders and wipers needed in all 40 patents. Pencils and 19 pencil sharpeners took 43 patents, petroleum burning and refining 7, and 1 was issued for making "phenylethylmethylpyrazolone," whatever that may be. The phonograph claimed 17 patents and photography 87, these being for cameras, films, shutters, printing devices and other apparatus. The piano even proved so imperfect as to take 69 patents, 19 of them being for action and others for frames, pedals, supports and so forth. Picture frames and hangers required 21, the pie lifter and the pie ventilator 1 each, the pillbox 1, and the pill machine 4. The pillow took 12, 10 of them being for pillow shams. Seventeen kinds of pipe took 158 patents, 26 being for pipe couplings, and 28 for pipe wrenches. One hundred and fifty-one of these patents relate to metal and vitrified piping, the tobacco pipe taking only 5 patents. The plane and planing machines took 20 patents, planters of various sorts 98, of which 6 are for potatoes, 7 for cotton, and 34 for corn. A curious title of one patent is "an anti-drip nose for a pitcher." An apparatus for playing duplicate whist took a patent. Pliers had 8, and the plow, supposed to be as nearly perfect as possible, was awarded 111 patents. Pneumatic signals, motors and carriers called for 10, the pocket book 13, and the pocket knife for 15. Six patents were granted for polishing machines, 12 for potato diggers, 1 for a means for killing poultry, and 1 for a poultry plucking machine. Thirty-three classes of presses are given 192 patents, of which the printing press took 72. One hundred and eighty-two patents are recorded under the head of "printing," 7 of them being for quoins, 5 for printing in colors, 42 for printing machines, and the rest for various devices and attachments to presses and for conveniences in a printing office. Projectiles took 11 patents, propellers 33, and 35 classes of protectors were protected by several score of patents. Pruning implements had 6, the pug mill 2, pulleys and attachments 45, devices for making and using pulp 16, while the pump was sufficiently imperfect as to find room for 140 patents, 4 of them being for beer, 10 for rotary pumps, 10 for vacuum pumps, and 10 for pumping engines. The punch and punching machines took 34, the push button 2, the puzzle 22, and quilting frames and machines 16. Thirty-two kinds of racks called for 1 more patent each. The radiator needed 26, a log raft 1, and a picker for rags and waste 1.

Railways and railway materials and supplies, exclusive of cars, were able to take 580 patents, 6 of them being for rail chairs, 16 for rail joints, 6 for cattle guards, 15 for railway chairs, 16 for crossing gates, 10 for frogs, 18 for other gates, 39 for rails, 34 for signals, 11 for spikes, 58 for switches and 43 for railway ties, 11 of these being for metallic ties. That scientific absurdities often find recognition is seen in the fact that a patent was issued for "producing rainfall." Ranges had 15 patents, rat traps only 2, the ratchet wrench 7, a raw hide mallet 1, and the razor strop 5. Refrigerators and refrigerator compositions required 30 patents. Seventeen classes of registers and 30 classes of regulators took patents in scores. Reins and rein holders needed 16, revolvers 9, and a rifle rest 1. Twelve classes of rings, exclusive of political ones, were given half a hundred patents, rivets and riveting devices 17, and rural journalism was assured of prolonged usefulness and protected from assault at vital points by a patent on a "cockroach trap." Roads and road making machines required only 12 patents, rock drills 15, the rocking chair 3, while rolling mills and machinery took 31, roofs and roofing 35, the roundabout 10, rubber handling machines 17, and protection seems to have been needed for "the saccharification of amylaceous matter."

The sad iron required 17 patents, the saddle 17, the safe 23, the safety pin 3, and 3 patents were granted for machines for destroying sage brush. Sand boxes, bands, and sand papering devices required 33 patents, sash took 114, of which 23 were for balances, 5 for guides, 40 for fasteners, and 17 for holders. Three patents were issued for sausage making, and 1 for a satchel and lunch bag. Saws, sawing machines, tools and devices took 156 patents, 25 of them being for machines, 18 for saw sets, 5 for band saws, and 30 for saw mills. Scaffolds took 9, scales of all kinds 49, scissors 7, scoops 6, the scow 4, scrapers 9, and patents in the title of which the word "screw" occurs number 59. Twelve classes of seats took patents, and 43 seeding devices and 18 kinds of separators were also patented. Under the heading "sewage" 19 patents are recorded, 4 of them being for pipe and 6 for traps. Patents on sewing machines and attachments reach the large number of 180. Ten classes of shears required 23 patents, sheet metal articles and machinery 41, shelves and shelving

6, shingles and shingle machinery 22, and the shirt 14. Shoes and shoe machinery got through the year with only 61 patents. Show cases needed 10, show stands 5, shutters 26, sieves and sifters 17. Eighteen kinds of signals and signaling apparatus were awarded 140 patents, the siphon 6, the skate 9, skirts and skirt forms 8, skylights 5, school slates 2, the sleigh 19, devices for slicing 8, smoke conductors and consumers 19, snap hooks 16, and snow guards and plows 17. Soap and soap devices accumulated only 13 new patents during the year. Solder and soldering devices 28, and machines for treating boot and shoe soles 24. Speaking tubes demanded 34 patents and spectacles 13. Speed governing and controlling devices had 18, spikes of different forms 12, spinning machines and devices 47, spools and spooling machines 20, spoons 6, and springs of 19 varieties took from 1 to several patents each. Sprinklers needed 10 patents, stamps of all descriptions 49, and 28 classes of stands were given patents. Station and street indicators needed 18, stave machinery 6, and a steak tenderer and a steak pounder 1 each. Titles of patents containing the word "steam" number 190, of which 34 are for generators and 55 for engines. Under the heading "steel" we find a record of 18 patents, stereotyping takes 12, the stirrup 4, the stocking 13, artificial stone 6, and stone machinery of all kinds 46. What is known as "store service" apparatus obtained 21 patents, and the stove, which we supposed had been perfected, found room for improvements which obtained 114 patents, 10 of them being for oil stoves and 15 for gas stoves. Strainers needed only 6 patents, straw stackers 9, the stuffing box 5, stump pullers and extractors 14, and a patent was awarded for a submerged heater. Sugar and its manufacture needed only 11 patents, the sulky 7, and surgical apparatus and implements 21. Suspenders required 21 patents, and 28 kinds of switches took fourscore of patents. The syringe claims 17, and 30 kinds of tables were also patented. Tack pullers and devices had 15 patents, tags 12, tanning processes 7, the tea kettle 3, and 2 were given for teeth separators. Telegraphy found room for improvements meriting 65 patents and the telephone 57. It is difficult to understand how so many improvements were possible in these two departments. Tents took 6 patents, thermometers 11, thermostats 6, and the tennis racquet 1. The thill actually obtained 70 patents, 58 of them being for thill couplings. Thrashers and thrashing machines took 40 patents, devices for holding and handling tickets 23, tile and tile making machinery 24, time recorders 13, apparatus for using tin 6, and tires of all kinds 59, 3 of them being for rubber tire, 4 for pneumatic tire, and 8 for tire tighteners. The toaster and the tobacco box each took 2 patents. Tobacco and conveniences for using and treating it took 52 patents, or one a week for the year. A patent was granted for a protector for "ingrowing toe nails." Tongue supports and tongs took 11 patents each. Under the heading "tools" we find a record of 32 patents. Artificial teeth were given 11, the top 6, the torpedo 9, and toys of all kinds 80, of which the deadly toy pistol had 4. Traction wheels and engines required 15, tramways 15, transom lifters 9, and traps of 24 classes carried off 92 patents. The tricycle needed only 9, the tripod 3. The trolley with its hangers, supports and switchers received 49 patents, or not one a week. Trousers, including protectors and stretchers, took 15 patents.

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## TABLE OF CONTENTS.


PAGE

I. AGRICULTURE.—Cockle Seed.—The ill effects of cockle seed in cattle feed, and what animals are badly affected by it..... 14352

II. DECORATIVE ART.—The Theory of Storiation in Art.—By Hugh Stannus.—A system of making decorative art tell a story.—The production of "histories and sermons which we can read without the trouble of turning over the leaves."..... 14347

III. ELECTRICAL ENGINEERING.—The Edison Multipolar Dynamos.—Different forms of multipolar dynamo and the direct coupled dynamos now running in this city.—1 illustration..... 14346

IV. ELECTRICITY.—Interesting Electrical Experiments.—A most interesting lecture by Lord Armstrong on dust figures and other electric phenomena.—By Lord Armstrong..... 14344

V. INVENTION.—An Age of Invention.—By Duane Doty.—An elaborate analysis of the official report of the Commissioner of Patents made before the United States Senate, February 1, 1893.—A most interesting presentation of the work done by inventors in this country..... 14336

VI. MEDICINE AND HYGIENE.—The Correct Pronunciation of Medical Terms.—By William Dulaney Thomas.—Incorrect pronunciation common among medical men, with examples of correct pronunciation..... 14353

The New Hospital for Children in Leipsig.—A graphic description, with numerous illustrations, of a German hospital for children.—9 illustrations..... 14350

VII. MISCELLANEOUS.—The Tour of Switzerland.—A second installment of this interesting description of the beauties of Switzerland, touching on the Rigi, the Pilatus, the Matterhorn.—8 illustrations..... 14354

VIII. NAVAL ENGINEERING.—The Chilean Armored Capitan Prat.—A new French ship, recently built for the Chilean government.—1 illustration..... 14347

The Use of Oil at Sea.—A practical and graphic article on this most interesting subject, showing exactly how oil is applied and different cases of its use.—5 illustrations..... 14346

IX. TECHNOLOGY.—Animal Charcoal as a Decolorizer.—By T. R. Carswell.—An elaborate examination of the decolorizing action of animal charcoal..... 14345

The Manufacture of Liquors and Preserves.—By J. De Brevans.—A further installment of this series of articles.—The determination of alcohol with Gay-Lussac's tables..... 14357



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## TABLE OF CONTENTS.


PAGE

I. AGRICULTURE.—Cockle Seed.—The ill effects of cockle seed in cattle feed, and what animals are badly affected by it..... 14352

II. DECORATIVE ART.—The Theory of Storiation in Art.—By HUGH STANNUS.—A system of making decorative art tell a story.—The production of "histories and sermons which we can read without the trouble of turning over the leaves."..... 14347

III. ELECTRICAL ENGINEERING.—The Edison Multipolar Dynamos.—Different forms of multipolar dynamo and the direct coupled dynamos now running in this city.—1 illustration..... 14346

IV. ELECTRICITY.—Interesting Electrical Experiments.—A most interesting lecture by Lord Armstrong on dust figures and other electric phenomena.—By LORD ARMSTRONG..... 14344

V. INVENTION.—An Age of Invention.—By DUANE DOTY.—An elaborate analysis of the official report of the Commissioner of Patents made before the United States Senate, February 1, 1892.—A most interesting presentation of the work done by inventors in this country..... 14350

VI. MEDICINE AND HYGIENE.—The Correct Pronunciation of Medical Terms.—By WILLIAM DULANEY THOMAS.—Incorrect pronunciation common among medical men, with examples of correct pronunciation..... 14352

The New Hospital for Children in Leipsig.—A graphic description, with numerous illustrations, of a German hospital for children.—9 illustrations..... 14350

VII. MISCELLANEOUS.—The Tour of Switzerland.—A second installment of this interesting description of the beauties of Switzerland, touching on the Rigi, the Pilatus, the Matterhorn.—8 illustrations..... 14354

VIII. NAVAL ENGINEERING.—The Chilean Armorclad Capitan Prat.—A new French ship, recently built for the Chilean government.—1 illustration..... 14347

The Use of Oil at Sea.—A practical and graphic article on this most interesting subject, showing exactly how oil is applied and different cases of its use.—5 illustrations..... 14346

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